The Blast Furnace and Steel Plant

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Branch Managers

JONES & SALE, Western Representatives
1014 Garrick Theatre Bldg.
Phone—State 4357
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ROBERT E. POWELL, Eastern Manager
29 West Thirty-fourth Street
Phone—Wisconsin 5495
New York, N. Y.

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The Blast Furnace and Steel Plant

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VISION

"LIGHT is the essential condition for vision." That is Webster's definition. ¶ But as there are two conceptions of vision, one to see what actually exists before our eyes, the other an ability to project our mind's eye into the prophetic future, controlled imagination for want of a better expression, there are naturally two conceptions of light; the first, light obtained from its natural source, the heavenly bodies, or from artificial sources; the second, light obtained from education, experiments, inspiration.

The Safety Crusade page in this issue contains a most concise treatise on the general subject of light and vision in its physical sense.

The entire safety movement and its world-wide application was and is based upon the second phase of light and vision. Without the keen imagination which aroused the pioneers against the unnatural and unnecessary crimes against humanity, no character or application of physical light would have been effective.

The combination has worked marvels.

The Application of Blast Furnace Gas and Air For Blowing A Gas Producer*

By G. R. McDERMOTT†

THE standard method in use at present for blowing gas producers, in the steel plant, is either by a steam turbine driven centrifugal blower or by a syphonic steam jet. The chemical reactions taking place in a gas producer are comparatively simple. At the junction of the ash and coke beds, the coke actually burns by combining with the oxygen of the air delivered by the blower and the burning gives off a large amount of heat with the production of carbon-dioxide, CO_2. The heat is utilized to heat the coal above, forming a bed of incandescent coke or carbon. Carbon-dioxide, CO_2, in passing up through the bed of hot coke is reduced to carbon-monoxide, CO. This reaction is endothermic, in that it requires heat. If a producer could be run by air alone, it would be ideal, but the heat generated by the combustion would melt the ashes produced, causing the formation of clinkers. Ash from a good coal should not fuse below 2200 deg. to 2500 deg. F., hence the temperature of the combustion zone should be slightly lower.

To prevent clinkering, the excess heat must be removed and the temperature of the combustion zone must be maintained below that of the melting point of the ash. This is accomplished by the addition of steam to the air, which in the case of the steam turbine driven blower is the exhaust from the turbine, while with the jet type of blowr the steam is used directly for drawing in the air and in doing so they are both mixed directly.

At the Illinois Steel Company's works at South Chicago, we were presented with the problem of the utilization of excess blast furnace gas other than that required for the production of electric and steam power. As a result we are operating six regenerative slab heating furnaces for the plate mills and at times blast furnace gas is used as fuel for open hearth furnaces. In both applications, the blast furnace gas is mixed with producer gas before they pass through the regenerators of the furnaces. In the case of the slab heating furnaces, the percentage of the total heat units supplied to the heating furnaces averages 55 per cent over a month's period, however when charging hot steel the percentage will at times be 75 per cent.

Still having an excess amount of blast furnace gas, the possibility of using blast furnace gas as a cooling agent in place of steam for blowing gas producers suggested itself. This gas, which is available had previously been washed at the blast furnaces, and as a result it is saturated with water vapor.

To conduct the investigation, one of the 10 foot water bottom, hand poked and fed Morgan producers, which supplied gas to the plate mill furnaces, was selected. The steam jet blower was removed and a steam turbine driven centrifugal blower installed. At first it was decided to try mixing the blast furnace gas and air in different proportions before introducing them into the producer by means of the turbine blower. Regardless of the proportions of gas and air, a great deal of trouble was experienced with clinkers, which formed at the bottom of the producer. Gas of poor quality was also the result. It was evident that when the mixture of gas and air entered the combustion zone, combustion took place and rather aggravated clinkering conditions than mitigating them. The expected endo-thermic reaction caused by the dissociation of the carbon-dioxide constituent of the blast furnace gas in the presence of the incandescent carbon of the producer did not develop.

Changes were made in the experimental equipment in order that the air and blast furnace gas could be introduced into the producer alternately. After considerable experimentation, the proper period and quantity of gas and air blow was determined which would give no serious or objectionable clinker formation.

The following is a summary of the experimental results to date:

Kind of coal fired in producer, Illinois Kelly 4 Mine Run
Calorific value .... 10,225 Btu. per lb., natural

Ultimate analysis of coal — per cent:

Carbon	59.15
H_2	4.35
N_2	1.35
O_2	9.63
Ash	11.80
S.	1.10
Moisture	12.62
Combustible in ash	10.10

	Producer Gas Analysis			Blast Furnace Gas Analysis
	Continuous Sample	Gas Blow Period	Air Blow Period	
CO_2	10.0	8.0	8.2	14.0
C_2H_4	0.4	0.3	0.3	0.0
O	...	...	...	...
H_2	4.7	7.4	6.0	3.4
CO	20.1	30.0	20.0	25.5
CH_4	2.5	2.2	2.8	.2
N_2	62.3	52.1	62.7	56.9
	100.0	100.0	100.0	100.0
Btu.	106.1	143.6	110.8	93.2

Quantity of air blown per hour — cu. ft.	51,500
Quantity of blast furnace gas blown per hour	21,450
Quantity of coal fired per hour — lbs., natural	1,100
Cu. ft. blast furnace gas per lb. coal	19.5
Cu. ft. air per lb. coal	46.8
Cu. ft. of producer gas per lb. coal	78.3
Temperature of producer gas — deg. F.	1,650
Btu. per cu. ft. of blast furnace gas	93.2
Btu. per cu. ft. of producer gas	106.01
Coal fired per hour — lbs.	1,155
Btu. per cu. ft. of producer gas	124.2
Cu. ft. producer gas per lb. coal	61.5
Lb. steam per lb. coal	0.4
Temperature of producer gas — deg. F.	1,650
Cu. ft. air per lb. of coal	45

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*Read before the Combustion Division, Association of Iron and Steel Electrical Engineers.

†Assistant Chief Engineer, Illinois Steel Company, South Works.

The following is a "Heat Balance" of a producer using a better grade of Illinois coal, however, it was blown by a mixture of steam and air. The producer was operated by the regular operating crew:

Kind of coal — Illinois, Universal No. 4 — Mine Run
Calorific value — 11,141 Btu. per lb., natural.

Ultimate Analysis

Carbon	63.56
H_2	4.36
N_2	1.18
O_2	9.88
Ash	9.22
S.	1.32
Moisture	10.48
Combustible in Ash	14.00

Producer Gas Analysis

CO_2	8.90
C_2H_4	.65
O_2	..
H_2	10.45
CO	19.04
CH_4	2.75
N_2	58.21

HEAT BALANCE

Heat Input/Lb. of Coal	Btu.	%	Heat Output/Lb. of Coal	Btu.	%
Calorific value of 1 lb. coal	11,141	95.9	Calorific value dry gas	7,640	65.7
Heat in steam entering producer	472	4.1	Sensible heat above 62 deg	2,020	17.4
			Total heat of moisture in gas	757	6.6
			Combustible in ash	154	1.3
			Unaccounted (tar vapor, soot, radiation)	1,042	9.0
Total charge	11,613	100.0	Total credit	11,613	100.0

Hot Gas Efficiency.................................. 89.7%
Cold Gas Efficiency.................................. 65.7%

HEAT BALANCE

Heat Input/Lb. of Coal	Btu.	%	Heat Output/Lb. of Coal	Btu.	%
Calorific value of coal per lb.	10,225	84.9	Calorific value of dry gas 78.3 x 106.1	8,290	68.7
19.5 cu. ft. of B. F. gas per cu. ft.	1,820	15.1	Sensible heat in dry gas above 62 deg	2,575	21.4
Heat in air and moisture in air not considered.			Total heat in moisture in gas	407	3.4
			Heat loss — combustible in ash	195	1.7
			Unaccounted (soot, tar vapor, radiation)	578	4.8
Total charge	12,045	100.0	Total credit	12,045	100.0

Hot Gas Efficiency 93.5%
Cold Gas Efficiency.................................. 68.7%

Considerable has been written regarding the evaluation of gaseous fuel with respect to their use in metallurgical furnaces, particularly the relative merits of carbon-monoxide and hydrogen. The calorific value of carbon-monoxide is 322 Btu. per cu. ft. while the net value of hydrogen is 274 Btu. per cu. ft. In an excellent paper recently read before a meeting of the West of Scotland Iron and Steel Institute by Prof. P. V. Wheeler, D.Sc., an attempt is made to evaluate gaseous fuels for furnace heating. Quoting from this paper, Dr. Wheeler makes the following statement: "A furnace charge receives the heat developed by a burning gas in two ways: in a small degree, by direct conduction from a portion of the flame itself and from the hot products of combustion; and, to the greater extent, by radiation from the flame and from the heated walls and roof of the furnace. Although carbon-monoxide and hydrogen have the same amount of heat, a carbon-monoxide flame radiates nearly two and a half times as much heat as a hydrogen flame burning the same volume of gas. On this score alone, therefore, a high content of carbon-monoxide is preferable to a high content of hydrogen in a producer gas for furnace work, since there will be a more effective heat transference if the charge by radiation and the efficiency of the system will in consequence be greater". Other investigators have also taken the stand that high hydrogen content in a producer gas is accompanied by high water vapor content in the gas caused by using a relatively high blast saturation temperature in the producer. The combined quantity of water vapor, that due to the combustion of the hydrogen and the vapor introduced with the blast, would mean a relatively high stack gas loss and reduced combustion efficiency.

By referring to the two "Heat Balances" given, it will be noted that there is almost twice as much heat in the moisture in the steam blown producer as compared with the blast furnace gas blown producer. Furthermore, on the supposition that carbon-monoxide has nearly two and a half times the radiation power as hydrogen, the total heat units released by the combustion of the carbon-monoxide and hydrogen in the gas of the test furnace per hour when compared with a like number of heat units resulting from the combustion of the carbon-monoxide and hydrogen in the gas of the steam blown producer, would give approximately 11 per cent greater furnace gas efficiency.

Regarding the economic aspect of coal displaced by the blast furnace gas in the producer and in the generation of steam for blowing the producer. It is estimated when based on the relative amounts of total carbon charged into each of the producers as shown by the "Heat Balance" that the blast furnace gas displaces 175 pounds of coal per hour as producer fuel and 89 pounds of coal consumed generating the steam used in blowing the producer or a total of 264 pounds per hour. The power required for blowing the test producer if the blower were motor driven, would amount to approximately an equivalent of 5 pounds of coal, resulting in a net saving of 259 pounds of coal per producer hour, a net saving of 20 per cent.

Only by actual operation on a furnace will it be possible to determine the relative value of the gas made by the method outlined as compared with a steam blown producer. The detrimental effect due to the greater quantity of inert nitrogen contained in the gas made by the experimental producer will be largely offset by the greater water vapor content of the steam blown producer.

No doubt much better results may be obtained by the new method of blowing if the experiments had been conducted on a mechanical producer and if a better grade of coal had been used. While conducting the investigation, the producer was operated by the regular crew and no attempt was made to give the producer undue attention. The producer bed contained the usual channels as indicated by the high gas temperature. This condition meant relatively high local gas velocity through the incandescent bed which no doubt reduced the amount of dissociation of the carbon-dioxide in the presence of the incandescent coke.

The Buying Power of Factory Workers

During the first six months of 1925, American factory workers received incomes at the rate of $9,730,000,000 a year, as compared with $6,946,000,000 in 1921, $9,096,000,000 in 1919, and $7,036,000,000 in 1914. During the first three months of 1925, factory workers' incomes were rising; during the next three they were falling and in July, according to preliminary data, they fell slightly further. The growth of industry is a contributing factor in the maintenance of large money incomes, but a more important factor is the prevailing high average wage rate which restriction of immigration, increasing industrial efficiency, and other fundamental conditions have made possible.

How incomes have changed, month by month, over the last five and one-half years is shown by the dashed line in the chart. This, like the other two curves, is given in percentages of the 1919-1922 average, which serves as a good basis for comparison.

How big a volume of goods and services can the aggregate money income buy? We have worked out and included in the chart a dotted line showing the changes in cost of living among factory workers.

A remarkable feature of this curve is its stability, or failure to rise and fall violently during the past three and one-half years as contrasted to its great flexibility during the two preceding years, 1919 and 1920. Since early 1922 this index has not fallen below 90 per cent nor risen above 95 per cent of the 1919-1922 average.

Owing chiefly to the stability of the living-costs curve, but in part to the growth of industry, the buying power or volume of "real income" of factory workers, as shown by the full line on the chart, has been greater during the larger part of the past three years than it had been even during the boom of 1919-1920. At that time high costs led to great consumer resistance — a thing impossible under more recent conditions of buying power, since "buyers' strikes" do not occur when the volume of purchasing power is large.

Will the buying power of factory workers be maintained? The chief factors in the situation are the amount of future employment for factory workers and the earnings they may be expected to receive. The recent turn downward in factory employment has come about to a large extent through lay-offs in the steel mills. Steel prices now have been reduced to stimulate buying, and the recent activity in the construction industry should have a beneficial effect upon steel orders. Construction contracts let during the first six months of the year in 36 Eastern States exceeded by $338,000,000 those of 1924 for the same period. The United States Department of Agriculture estimates that the total state and local highway expenditures in 1925 will exceed $1,000,000,000—a construction program larger than any since 1921. These and other factors are making for extensive outdoor employment during the summer.

A decline in the money income of factory workers occurring during the last four months is due in part to seasonal causes, but reports from manufacturing centers indicate that the discharges now being made will not affect large numbers and that conditions of the summer of 1924 will not be repeatd in 1925.

In spite of set-backs in some lines of industry and certain wage cuts, the buying power of large groups of American consumers is substantially as great as during the boom of 1919-1920. Not only the essentials of life, such as ordinary grades of food and clothing, but also many luxury and semi-luxury goods have been moving freely into the hands of consumers. This favorable relation between money income and the cost of living is a principal reason for the large trade in commodities used by the consuming public, the tendency to accumulate savings, and the heavy sale of life insurance in all its forms for the first six months of 1925 which has risen 15 per cent above the corresponding period of 1924. Notwithstanding minor fluctuations in employment, the buying power of factory workers promises to remain fairly stable during the rest of 1925.

Extension Work in Welding

The Lincoln Electric Company of Cleveland, this fall will extend in co-operation with the Cleveland School of Technology, the facilities by which young men are being trained in electric arc welding. For the past two years the Lincoln Electric Company, builders of the "Stable-Arc" welders, has been providing practical training in welding for students entered in the school, which is part of the Y. M. C. A. educational system.

The plan which the Lincoln Electric Company has developed, and which is to be extended this year, provides for alternating five week training courses by which half of the time of students is spent in the manufacturing plants and the balance in the class rooms of the School of Technology. Through the practical experience gained in the factory, where an opportunity is given to see not only how the stable arc welders are made, but also to see the application of welding in the construction of the "Link-Weld" electric meters, the students are so trained as to make them practical welding experts upon graduation.

The work is being done in connection with the Y. M. C. A. engineering course, which requires three years for completion.

A. S. S. T. Ready For Annual Convention

Seventh Annual Convention and Exposition of the American Society for Steel Treating Expected to Surpass All Previous Gatherings of This Organization

THE American Society for Steel Treating is preparing for its Seventh Annual Convention and National Steel Exposition scheduled to be held in Cleveland, the home of the Society, from September 14 to 18. Most of the details have been worked out by Mr. W. H. Eisenman, the Society's secretary, and it is reported that this year's convention and exhibition will surpass all previous efforts of the society.

The technical papers, like those of previous years, stand out in great prominence and are of splendid caliber, presenting the latest advances in research and investigation in the metallurgy of metals. Men of recognized authority in the industry will present new and worthwhile ideas. A new and valuable departure this year is the preprinting of papers to be presented, and this innovation should add greatly to the interest and discussion of the papers.

Hardness Symposium.

The work of the Hardness Testing Committee of the National Research Council has been turned over to the A. S. S. T. The same committee that accomplished such excellent results under the National Research Council will continue with the A. S. S. T. The Hardness Testing Symposium will be held on Wednesday, September 16, at 2 P. M. at the Hollenden Hotel. The reorganized committee, under the direction of the A. S. S. T., has prepared an especially attractive program. The list of papers follows:

"English Hardness Testing Machine of the Brinell Principle," by Prof. O. W. Boston, University of Michigan.

"Checking Brinell Machines," by Captain S. N. Petrenko, Bureau of Standards.

"Some Comparisons Between the Rockwell and Brinell Hardness," by R. C. Brumfield, Materials Testing Laboratory, Cooper Union.

"Hardness of Cold Rolled Nickel," by Dr. S. R. Williams, Director of Laboratory, Amherst College.

"The Hardness and Toughness of High Speed Steel as Affected by Heat Treatment," by Robert K. Barry, Barry Company, Muscatine, Iowa.

"Stress-Strain Curves and the Characteristics Which Are Associated with Hardness," by H. P. Hollnagel, Department of Physics, Thomson Research Laboratory, General Electric Company, West Lynn, Mass.

Conference on Metallurgical Education.

Metallurgical education has occupied a very important part in the deliberations of the society due to the great interest of the members in the subject. This year instead of devoting an afternoon to the program, it has been decided to hold a luncheon conference. The preparation of this conference is under the direction of Dr. O. E. Harder, Professor of Metallography, University of Minnesota.

Manufacture of Steel.

One technical session will be devoted to the manufacture of steel. This will consist of four papers, one serving as an introduction showing the relationship of the total production of steel to the proportion heat treated. There will be three papers presented on the following subjects: Basic Open Hearth, Acid Open Hearth and Electric Furnace Steel.

The first paper on proportion of heat treatment to production will be presented by C. J. Stark, editor of Iron Trade Review. The subject of "Basic Open Hearth Steel" will be presented by Radcliffe Furness of the Midvale Company, while "Acid Open Hearth Steel" will be presented by Edward Whitworth of the Bourne-Fuller Company. The third paper on "Electric Furnace Steel" will complete the program. The high standing of the contributors to this session point to its being one of the most attractive of the week.

Plant Inspection.

Plant inspection is under the direction of George Allen, Kirby Bldg., whose committee has made arrangements for scheduling plant inspection on Tuesday, Wednesday and Friday afternoons. Optional visits for these days have been provided. Considering the wide variety of manufacturing in Cleveland there will, undoubtedly, be many members and guests who will desire to take these trips. Mr. Allen's committee has further provided for inspection of other plants than those included in the main group. These trips may be made upon application to the committee.

S. A. E. Production Meeting.

The Production Meeting of the S. A. E. is to be held in Cleveland the same week as the convention of the A. S. S. T. and National Steel Exposition, the week of September 14. Details for this production meeting have been worked out and the tentative program includes technical sessions on Monday, Tuesday and Wednesday, September 14, 15 and 16. The Winton Hotel will be the headquarters for the S. A. E. and the technical sessions will be held in the Rainbow Room. The Cleveland committee for the S. A. E. Production Meeting, under the direction of John Younger, 2010 East 102nd Street, will co-operate with the A. S. S. T., and the features of entertainment for the men, as well as the ladies, will be a joint affair.

Among the subjects to be discussed will be the following:

"Foremanship Training."

"Employee Training."

"Economic Study of Machine Tool Equipment."

"What to Purchase and What the Automotive Industry Needs in Machine Tools."

"Session on Sheet Steel."

"Production Methods in the Heat Treating Department."

A. S. M. E. to Participate.

The participation of the A. S. M. E. with the A. S. S. T. will take the form of a session on Machine Shop

Practice, to be contributed by the Machine Shop Practice Division of the A. S. M. E. Mr. F. H. Colvin, editor of The American Machinist, has been appointed by the executive committee of the division to take charge of securing papers on Machine Shop and Machine Shop Practice. The papers will be presented on Thursday afternoon at the Hollenden Hotel.

The Exposition.

The great Cleveland Public Auditorium has been entirely reserved by exhibitors for the National Steel Exposition. This will be the largest exposition that the Society has ever held, and the largest steel exposition ever held in the world. Both of the extensive floors of the Auditorium as well as the stage have been reserved by exhibitors who will have their products on display. This Steel Exposition represents a complete cycle in the metal working and the metal treating industry.

Ninety makers of machine tools and small tools will have exhibits in operation and many others will show metals, metal treating equipment, testing and inspection equipment. There will be shown the most modern works used in the treating of steel and in the manufacture of steel products, small and large.

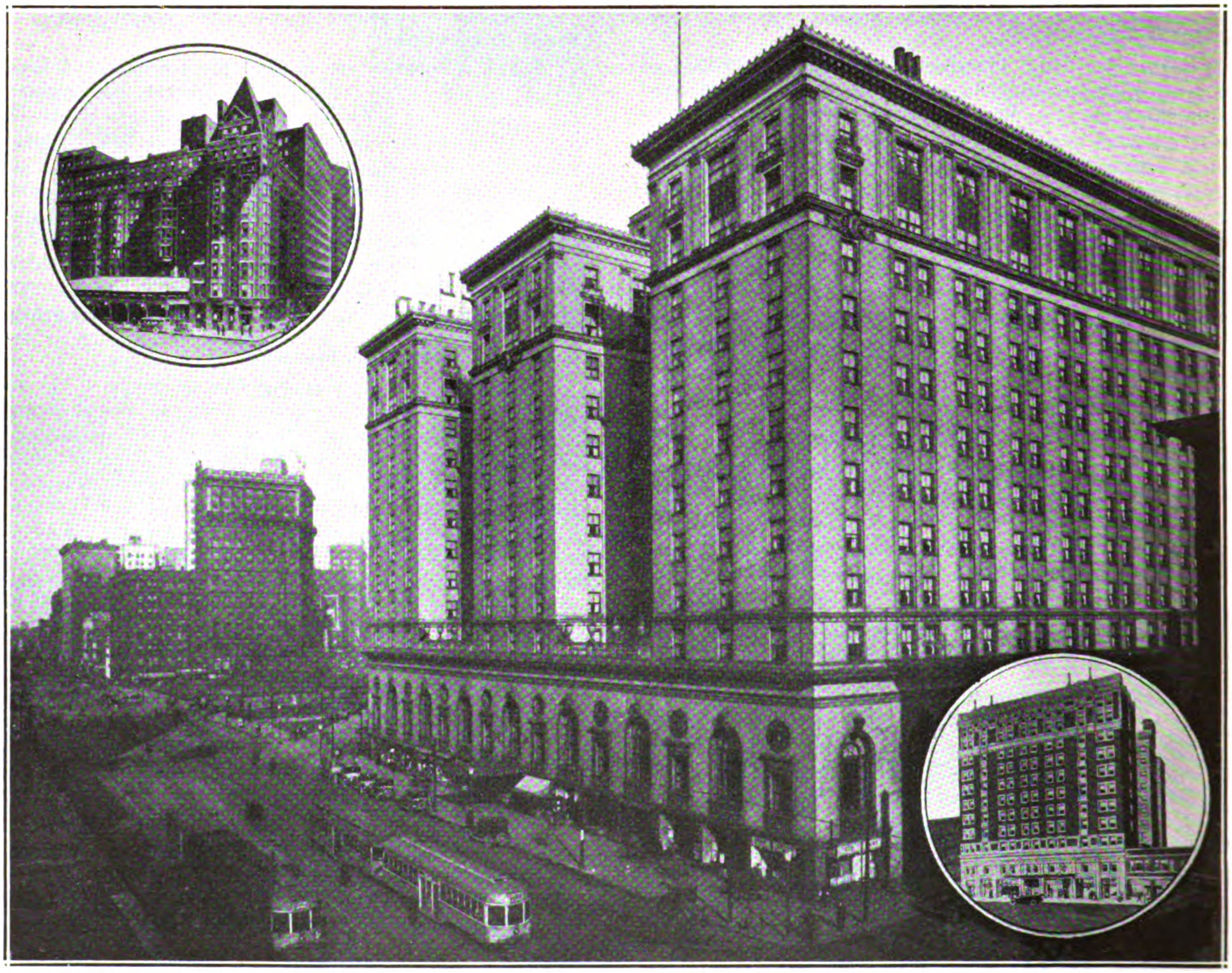
Men's Entertainment.

Those who have attended the past six conventions of the Society realize that besides the wonderful score of technical sessions and the exposition, the host chapter always arranges a series of entertainment having a tendency to add relaxation and enjoyment to educational process. The men's entertainment committee, under the leadership of W. J. Abel, has arranged a schedule of entertainment which bids fair to go down in history as probably the most complete and enjoyable of any so far experienced. The numerous country clubs around Cleveland will be glad to receive the golf enthusiasts.

The annual smoker will be held in the Rainbow Room, Winton Hotel, Tuesday, September 15th, and the dance and banquet at the Hotel Cleveland on Wednesday and Thursday, respectively. This provides for two open evenings, Monday and Friday, when the visiting guests will have time for the selection of such events as may interest them.

Ladies' Entertainment.

As usual, extensive preparations have been made for the entertainment of the ladies who will accompany the members, guests and exhibitors. The enter-



Hotel Cleveland, headquarters for the Eighth Annual Convention, American Society for Steel Treating. Upper insert—Hollenden Hotel, where afternoon sessions will be held. Lower insert — Winton Hotel, headquarters for the Society of Automotive Engineers.

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tainment committee is under the expert direction of Professor and Mrs. H. M. Boylston. The headquarters for the ladies will be in the Hotel Cleveland. The tentative schedule of events is as follows:

Monday, September 14—Luncheon, Hotel Cleveland.

Tuesday, September 15—Drive to Nela Park, going out through the parks and Bratenahl and returning through the Heights in the afternoon. Preliminary luncheon to be served at Nela and the ladies are to be shown the house lighting exhibit and other features of interest. Evening—Theater party.

Wednesday, September 16—In afternoon, entertainment at Women's Club. In evening, dance at Hotel Cleveland.

Thursday, September 17—In afternoon, short automobile ride through the West Side, possibly returning through industrial district over the Pershing Avenue viaduct. In the evening, banquet at Hotel Cleveland.

Convention Committees.

The committees for the various activities are as follows:

J. B. Dillard, general chairman, Cleveland Twist Drill Company.

H. A. Schwartz, chairman, Cleveland Chapter A. S. S. T., National Malleable & Steel Castings Company.

A. S. Townsend, secretary, Cleveland Chapter A. S. S. T., Cleveland Twist Drill Company.

W. S. Bidle, president, A. S. S. T., W. S. Bidle Company.

E. C. Smith, chairman, Meetings and Papers Committee, Central Steel Company.

W. C. Bell, chairman, Finance Committee, Case Hardening Service Company.

H. M. Boylston, vice chairman, Ladies' Entertainment Committee.

W. F. Abel, chairman, Men's Entertanîment Committee, 2589 Euclid Blvd.

J. V. Emmons, chairman, Information Committee, Cleveland Twist Drill Company.

A. H. Frauenthal, chairman, Transportation Committee, Chandler Motor Company.

W. H. White, chairman, Hotels Committee, Atlas Alloy Steel Corporation.

G. J. Allen, chairman, Plant Inspection Committee, Heppenstall Forge & Knife Company, Kirby Bldg.

Cleveland--A Progressive Industrial Center

Development of Cleveland as a Lake Port a Big Factor in Placing the City in the Front Rank of Industrial Centers—Products Are Widely Diversified

FROM an isolated trading post in the wilderness in 1790 to a thriving metropolis in 1925—this, in a nutshell, is the history of Cleveland. The city has grown by steady, substantial processes, until it now ranks fifth in the United States in population. It is among the 30 largest cities in the world. Situated as it is, on the southern shore of Lake Erie, at the logical and most economical meeting point of ore, coal and limestone, Cleveland has become a power in industry.

In the short span of years the trading post of a score of people has grown into a city covering 68 miles. Skyscrapers have replaced the log cabins of early pioneer days, miles of paved streets have taken the place of a few Indian trails, while homes have sprung up on the ground that a century ago was wilderness and waste.

Moses Cleaveland, Founder.

Cleveland owes its location to Moses Cleaveland, chief surveyor for the Connecticut Land Company, who set out in the spring of 1796 to survey a tract of 3,000,000 acres that is now Northern Ohio. Cleaveland and his small band of associates landed on the banks of the Cuyahoga River, where it joins Lake Erie, in July of the same year. In September they laid out the site of the city a mile square on the bluff overlooking the lake. The early growth of the city was slow and marked by many hardships and much suffering. Four years after its founding, Cleveland boasted a population of but 25 persons. In 1820 there were 600, which grew to 6,071 in 1840. From that time to 1880 Cleveland practically doubled its population every ten years. In 1900 the population reached 381,000 and in the last quarter of a century this figure has almost been tripled.

Lake Port Development.

Development of Cleveland as a lake port, a big factor in placing the city in the front rank of industrial centers, played an important part in the growth of the population. The first steamboat on Lake Erie "The Walk-in-the-Water," made her maiden trip from Buffalo to Cleveland in August, 1818. At that time there were numerous small sailing vessels plying up and down the lake and many of these brought new faces to Cleveland. Daily arrivals of boats loaded with five or six hundred persons were not uncommon. Many of these emigrants foresaw the material advantages of Cleveland's geographical location on a great inland waterway and went no farther.

It was not until the year 1852 that the ship "Baltimore" entered Cleveland's harbor with the first cargo of iron ore from the Lake Superior region and paved the way for a great industry. More than 800 large ships now ply the Great Lakes. With 14.2 miles of lake frontage protected by a breakwater 5¾ miles long, a harbor amply supplied with docks, both along the lake shore and along the banks of the Cuyahoga river, Cleveland is well able to meet the demands of this ever-increasing business on the lakes.

Within the boundaries of Cleveland more than 3,000 plants, with 200,000 wage earners, annually manufacture in excess of a billion dollar's worth of products. The capital invested exceeds $762,000,000.

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TENTATIVE PROGRAM
SEVENTH ANNUAL CONVENTION
AMERICAN SOCIETY FOR STEEL TREATING
CLEVELAND, SEPTEMBER 14-18, 1925

MONDAY, SEPTEMBER 14

Morning Session

Meeting in Ball Room, Hotel Cleveland

10:00—Welcome by Cleveland Chapter—H. A. Schwartz, Chairman.
Address of Welcome—Colonel Dillard, General Chairman.
Response—President W. S. Bidle.

Technical Session

10:15—"Interpretation of Notched Bar Impact Test Results"—Paul Heymans, Massachusetts Institute of Technology, Cambridge, Mass.

10:50—"Chemical Composition of Tool Steels"—J. P. Gill and M. A. Frost, Vanadium Alloys Steel Co., Latrobe, Pa.

11:25—Experiments with Nickel, Tantalum, Cobalt and Molybdenum in High Speed Steels—H. J. French, Bureau of Standards, Washington, D. C.

Afternoon Session

1:00—Exposition opens.

2:00—Technical Session—Ball Room, Hotel Hollenden.
Chairman, Dr. A. E. White.

2:00—"Effect of Cold-Work on Endurance and Other Properties of Metals," D. J. McAdam, Jr., U. S. Naval Engineering Experiment Station, Annapolis, Md.

2:40—"Graphitization at Constant Temperature," H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.

3:20—Some Factors Affecting Coercive Force and Residual Induction of Some Magnet Steels," J. R. Adams and F. E. Goeckler, Midvale Co., Nicetown, Philadelphia, Pa.

Evening Session

Exposition open until 10:00 P. M.

TUESDAY, SEPTEMBER 15

Morning Session

Meeting in Ball Room, Hotel Cleveland
Chairman, Dr. J. A. Mathews.

9:30—Steel Melting Session.

9:30—"Proportion of Heat Treated Steel to Total Production," C. J. Stark, Iron Trade Review, Cleveland.

9:50—"Acid Open Hearth Steel," Radclyffe Furness, Midvale Co., Nicetown, Philadelphia.

10:30—"Basic Open Hearth Steel," Edward Whitworth, Bourne-Fuller Co., Cleveland.

11:15—"Electric Furnace Steel," F. T. Sisco, McCook Field, Dayton, Ohio.

12:30—"Metallurgical Education Symposium Luncheon," Hotel Cleveland. Chairman, Dr. A. E. White.

Afternoon Session

1:00—Exposition opens.

1:30—Plant Inspection, Midland, Steel Products Company or National Carbon Company.

2:00—Technical Session—Ball Room, Hotel Hollenden. Chairman, Dr. Zay Jeffries.

2:00—"Comparative Slow-Bend and Impact Notched Bar Tests on Some Metals," S. N. Petrenko, Bureau of Standards, Washington, D. C.

2:40—"Effect of Reheating on Cold Drawn Bars," S. C. Spalding, Halcomb Steel Co., Syracuse, N. Y.

3:20—"Application of the Mathematics of Probability to Experimental Data as a Basis for Appropriate Choice of Ferrous Materials," B. D. Saklatwalla and H. T. Chandler, Vanadium Corporation of America, Bridgeville, Pa.

Evening Session

6:00—Dinner Meeting of Committee E-4, A. S. T. M.—Old Colony Club, Hollenden Hotel.

9:30—Annual Smoker and Entertainment.

Exposition open until 10:00 P. M.

WEDNESDAY, SEPTEMBER 16

Morning Session

Meeting in Ball Room, Hotel Cleveland

9:30—Annual Meeting of the American Society for Steel Treating. Chairman, W. S. Bidle.
Report of Chapter Delegates.
Report of Officers.

Technical Session

Chairman, Dr. G. K. Burgess

10:30—"Retained Austenite — A Contribution to the Metallurgy of Magnetism," Dr. John A. Mathews, Crucible Steel Company of America, New York City.

11:15—"On Martensite," Dr. H. Hanemann, Technischen Hochschule, Charlottenburg, Germany. (To be presented by Dr. S. L. Hoyt.)

Afternoon Session

1:00—Exposition opens.

1:30—Plant Inspection, White Motor Car Company or Van Dorn and Dutton Company.

2:00—Technical Session Ball Room, Hollenden Hotel. Chairman, E. C. Bain.

2:00—The Carbon Content of Pearlite in Iron Carbon Alloys Containing One Per Cent Silicon," Anson Hayes and H. U. Wakefield, Iowa State College, Ames, Iowa.

2:30—"Irregular Carburization — Its Causes and Preventions," W. J. Merten, Westinghouse Electric & Manufacturing Co., East Pittsburgh.

3:00—"A Study of Dendritic Structure and Crystal Formation," Bradley Stoughton and F. J. G. Duck, Lehigh University, Bethlehem, Pa.

3:30—"Oil Burning Equipment for Industrial Furnaces," M. H. Mawhinney, General Furnace Co., Pittsburgh.

Evening Session

9:30—Annual Dance, Ball Room, Hotel Cleveland.

Exposition open until 10:00 P M.

THURSDAY, SEPTEMBER 17

Morning Session

Meeting in Ball Room, Hotel Cleveland

9:30—Technical Session. Chairman, Dr. Albert Sauveur.

9:30—"Initial Temperature and Mass Effects in Quenching," H. J. French and O. Z. Klopsch, Bureau of Standards, Washington, D. C.

10:20—"On the Nature of Some Low-Tungsten Tool Steels," M. A. Grossmann, United Alloy Steel Corp., Canton, Ohio, and E. C. Bain, Union Carbide & Carbon Research Laboratories, Long Island City, N. Y.

11:10—"Effect of Cold Working on Hollow Cylinders," Dr. F. C. Langenberg, Watertown Arsental, Watertown, Mass.

Afternoon Session

2:00—A Session Contributed by the American Society of Mechanical Engineers, Machine Shop Practice Division. Ball Room, Hollenden Hotel.
"Modern Surface Grinding," Henry K. Spencer, Blanchard Machine Co., Cambridge, Mass.
"Dies," Mr. Keller, Kellér Mechanical Engineering Corp., Brooklyn, N. Y.
Titles of other papers to be supplied later.

2:00—"Symposium," Hardness Testing Committee of the A. S. S. T. Hollenden Hotel. Chairman, A. E. Bellis.

2:00—"Electric Ring for Verification of Brinell Hardness Testing Machines," S. N. Petrenko, Bureau of Standards, Washington, D. C.

2:20—"Some Comparisons Between Rockwell and Brinell Hardness," R. C. Brumfield, Cooper Union, New York City.

2:40—"Hardness and Toughness of High Speed Steel as Affected by the Heat Treatment," R. K. Barry, Barry Co., Muscatine, Iowa.

3:00—"Stress-Strain Curve and the Characteristics Which Are Associated with Hardness," H. P. Hollnagel, General Electric Co., West Lynn, Mass.

3:20—"English Hardness Testing Machine of the Brinell Principle"—O. W. Boston, University of Michigan, Ann Arbor, Mich.

3:40—"The Durometer—An Instrument for Testing Hardness" Dr. Albert Sauveur, Harvard University, Cambridge, Mass.

5:30—Exposition closes for the day.

Evening Session

6:30—Annual Banquet of the A. S. S. T., Ball Room, Hotel Cleveland.

FRIDAY, SEPTEMBER 18

Morning Session

9:30—Technical Session, Ball Room, Hotel Cleveland. Chairman, Bradley Stoughton.

9:30—"Carburization by Solid Cements," W. E. Day, Jr., International Motor Co., New Brunswick, N. J.

10:20—"Dilatometric Method of Heat Treatment," O. E. Harder, R. L. Dowdell and A. C. Forsythe, University of Minnestota, Minneapolis, Minn.

11:10—"What Happens When Metal Fails by Fatigue," Prof. H. F. Moore, University of Illinois, Urbana, Ill.

Afternoon Session

Exposition opens at 1 P. M.

1:30—Plant Inspection, F. H. Glidden Company or the American Steel & Wire Company, Cuyahoga Plant.

2:00—Technical Session, Ball Room, Hollenden Hotel.
Chairman, H. M. Boylston.

2:00—"Why Metal Warps and Cracks," J. F. Keller, Purdue University, Lafayette, Ind.

2:40—"Design and Operation of Furnaces for Salt Baths"—Sam Tour, Doehler Die Castings Co., Batavia, N. Y.

3:20—"Welding Steel Tubing and Sheet with Chrome Molybdenum Welding Wire," F. T. Sisco and H. W. Boulton, McCook Field, Dayton, Ohio.

Evening Session

10:00—Exposition officially closes.

LIST OF EXHIBITORS AT THE PUBLIC AUDITORIUM

Name	Booth No.
Abrasive Machine Tool Co.	250
Acme Machine Tool Co.	254
Air Reduction Sales Co.	271 and 281
Ajax Mfg. Co.	3
Allen Co.	213
American Gas Furnace Co.	220-221-222
American Resistor Co.	116-A
American Stainless Steel Co.	81
American Tool Works	224-225
Ames & Co.	210
Anchor Drawn Steel Co.	84
Andresen & Associates, Inc.	11
Armstrong-Blum Mfg. Co.	45
Armstrong Cork & Insulating Co.	57
Atkins & Co.	100
Atlas Alloy Steel Corp.	118
Avey Drilling Machine Co.	253
Badger Tool Co.	258
Baker Brothers	246
Bath & Co., Inc.	47
Bausch & Lomb Optical Co.	24
Bellevue Industrial Furnace Co.	121
Bellis Heat Treating Co.	117
Bethlehem Steel Co.	20, 21, 31 and 32
Bilton Machine Tool Co.	217
Black & Decker Mfg. Co.	46
Blanchard Machine Co.	256
Bristol Co.	35
Brown Instrument Co.	65-66
Brown & Sharpe Mfg. Co.	234-235
Brown Lynch Scott Co.	120-A
Bullard Machine Tool Co.	253
Bureau of Standards	113
Campbell, Inc.	232
Carborundum Co.	17
Carpenter Steel Co.	48
Case Hardening Service Co.	41
Celite Products Co.	102
Central Steel Co.	51, 52, 67 and 68
Cincinnati Bickford Tool Co.	257
Cincinnati Milling Machine Co.	255
Cincinnati Planer Co.	252 and 261
Cincinnati Shaper Co.	217
Cleveland Automatic Machine Co.	233
Cleveland Twist Drill Co.	269, 270 and 280
Colonial Steel Co.	26-37
Cooper Hewitt Electric Co.	206
Crucible Steel Co. of Am.	74-75-76
Davenport Machine Tool Co.	250
Davison Gas Burner & Welding Co.	216
Dearborn Chemical Co.	63
Disston & Sons, Inc.	22
Donner Steel Co.	93
Driver-Harris Co.	95
Electrical Refractories Co.	120-B
Electric Furnace Co.	116-B
Electro Alloys Co.	114-A
Engelhard, Inc.	53
Ex-Cell-O Tool & Mfg. Co.	287
Firth Sterling Steel Co.	14-15
Ford Company	56
Forging-Stamping-Heat Treating	34-A
Ganschow Company	62
Gardner Tap & Die Co.	18
Gathmann Engineering Co.	107
General Alloys Co.	42 and 58
General Electric Co.	99
Geometric Tool Co.	233
Giddings & Lewis Machine Tool Co.	245
Gisholt Machine Co.	223-A
Goddard & Goddard Co.	90
Goss & DeLeeuw Machine Co.	266-B
Gould & Eberhradt, Inc.	247
Gray Company	237
Hagan Company	13
Halcomb Steel Co.	85-86
Hammond Mfg. Co.	212
Hanson-Whitney Machine Co.	282
Heald Machine Co.	267-268
Heim Grinder Co.	215
Heppenstall Forge & Knife Co.	106
Hevi-Duty Electric Co.	23
Holcroft & Co.	16
Hoskins Mfg. Co.	98
Houghton & Co.	54-55
International Machine Tool Co.	215
International Nickel Co.	78 and 99
Interstate Iron & Steel Co.	108
Iron Age Publishing Co.	83
Jessop Steel Co.	119
Jones & Lamson Machine Co.	229-230
Jones & Laughlin Steel Corp.	79
Kardex-Rand Co.	Lobby
Kearney & Trecker Corp.	205
Keller Mech. Engineering Corp.	248-249
Kelly Reamer Co.	284
Keystone Lubricating Co.	88
King Machine Tool Co.	236
King Refractories Co.	19
Knight Machinery Co.	214
Landis Tool Co.	293-294
Leeds & Northrup Co.	10
Lehmann Machine Co.	285
Leitz, Inc.	35
Leland-Gifford Co.	204
Liberty Machine Tool Co.	218-219
Lodge & Shipley Machine Tool Co.	260
Lucas Machine Tool Co.	242
Ludlum Steel Co.	29-30
Marschke Mfg. Co.	292
Midvale Company	77
Monarch Machine Tool Co.	207
Morris Machine Tool Co.	286
Morse Twist Drill & Machine Co.	82
Motch & Merryweather Machinery Co.	244 to 261
National Automatic Tool Co.	228 and 238
National Electric Light	110
National Equipment Co.	259
Nat. Twist Drill & Tool Co.	265 and 275
Neumann's Successors, Inc.	288
New Britain Machine Co.	239-240
Norton Company	231 and 241
Nuttall Company	59
O. K. Tool Co.	276
Oesterlein Machine Co.	289
Ohio Steel Foundry Co.	38
Oilgear Company	226
Oliver Instrument Co.	227
Olsen Testing Machine Co., Tinius	43
Oxweld Acetylene Co.	101
Park Chemical Co.	111
Peerless Machine Co.	12
Pels & Co.	291
Penton Publishing Co.	40
Pittsburgh Crucible Steel Co.	87
Pittsburgh Instrument & Machine Co.	103
Potter & Johnston Machine Co.	223-B
Pratt & Whitney Co.	277-278
Production Machine Co.	251
Republic Flow Meters Co.	69-70
Rockford Machine Tool Co.	287
Rockford Milling Machine Co.	287
Rockwell Co.	61
Rodman Chemical Co.	84
Roessler & Hasslacher Chemical Co.	44
Sebastian Lathe Co.	290
Seneca Falls Machine Co.	295
Shore Instrument & Mfg. Co.	34-B
Simonds Saw & Steel Co.	72-73
Skinner Chuck Co.	92
Skybrite Co.	109
Spencer Turbine Co.	223
Stamets Company	282 and 292
Standard Tool Co.	92
Starrett Co.	94
Strong, Carlisle & Hammond Company	207 to 216 and 224 to 238
Strong, Carlisle & Hammond Company	104-105
Sun Oil Co.	115
Surface Combustion Co.	36
Swindell & Bros.	28 and 39
Swedish Crucible Steel Co.	27
Taylor Instrument Co.	112
Taylor & Fenn Co.	283
Thompson Grinder Co.	259
Thompson & Sons Co.	60
Timken Roller Bearing Co.	71
United Alloy Steel Corp.	49
Union Twist Drill Co.	272-273
Universal Grinding Machine Co.	279
Vanaduim-Alloys Steel Co.	64
V & O Press Co.	254
Walcott Lathe Co.	264 and 274
Warner & Swasey Co.	262-263
Westinghouse Elec. & Mfg. Co.	96-97
Wheelock, Lovejoy & Co., Inc.	80 and 91
Whitney Mfg. Co.	282
Wilmarth & Morman Co.	243
Wilson-Maeulen Co.	25

Qualities of Fire Brick From A Metallurgical Standpoint*

By PROF. W. GRUM-GRJIMALLO, Moskau

BY the proper selection of materials the corrosion of the walls of blast furnaces can be overcome. It is not always necessary to use the best fire brick, but it will answer the purpose if they are selected according to the temperature and strain they have to withstand. Frequently, for lower temperatures, the ordinary red clay brick fired in an annular kiln at 800-900 deg. C. can be used for temperatures under 600 deg. C., such as snoreholes for steam boilers, air heaters, regenerators and hot air ducts. Fire brick which has to withstand friction or chemical action through slag or gases should be manufactured according to special methods.

I. The subsequent shrinking of fire brick can be overcome by securing a stability of volume in the firing. As clay will shrink up to the sinter point, the bricks should be fired up to that point or should be made from non-shrinking quarz sand to which very little clay has been mixed.

II. Swelling occurs only with (poorly fired) quarz bricks which increase in volume up to 3.3 per cent when transforming into Tridymite. With fire clay or quarz-fire clay the distention by heat is normal and must be compensated by grooves. For the size of these grooves the following suggestions are made:

(a) Martin furnace, glass furnace and furnaces of which the operating temperature is higher than the softening point of the mortar used in their construction should have very thin grooves.

(b) Furnaces in which the softening point of the mortar is above that of the bricks require wider grooves. When the furnace is heated, the groove contracts, the inside end of the brick expands, compensating each other, so that no openings form. The higher the working space of the furnace, the wider should be the grooves. For wide grooves it is advisable to add to the clay used as mortar, saw dust, pulverized charcoal or coke. These admixtures after being burned out leave pores and the groove thus becomes elastic, which is essential for high furnaces with wide grooves.

III. In one sidedly heated furnaces, bricks, the softening point of which is below the operating temperature, may be used without danger. The inside ends of the bricks bake to a monolithe and thereby form a heat protector for the outside end of the bricks, which then form the supporting structure. This structure, however, is usually destroyed when the furnace is allowed to cool, because the monolithe cracks.

Bricks of which the softening point is below the operating temperature should not be used for furnaces in which both sides of the walls are heated, such as the Siemens furnace. It must also be taken into consideration that the softening occurs frequently long before the melting point is reached. The softening point is identical with the adoption of a plastic stage, i. e., when the fire brick no longer resists a pressure of 1 kg. per 1 cm^2, and for good clay with a melting point of about 1730 deg. C. lies at about 1300 deg. C. Some clays soften readily at 1150 deg. C. and such material should not be used for furnaces which are operated at a higher temperature than that.

Since Kaolin and fire clay lose their heat resisting power far below their melting point, another material had to be found for Martin furnaces, the quarz brick which was transformed into tridymite and christobalite. It withstands well the temperature of the Martin furnace which approaches its melting point, and resists mechanical influences by friction in coke furnaces because the formaton of the tridymite crystals in this case has a monolithic character. The extreme hardness of the quarz brick is explained by its formation.

By dissolving the quarz (spec. grav. 2.65) in iron containing fluor the individual quarz grains are recrystallized into agglomerated tridymite crystals (spec. grav. 2.32) which have an extraordinary hardness even in high temperatures, when the heavy iron-fluor is dislodged from the brick.

Summing up we may say:

1—Ordinary red bricks with fire clay as mortar for temperatures of 600-700 deg. C.

2—Quarz-fire clay bricks for temperatures 700-1200 deg. C.

3—Extra high softening fire bricks for temperatures up to 1450 deg. C.

4—Magnesite and chromite bricks at 1500 deg. C. are already too weak for arches, but may be used for straight walls up to 1600 deg. C. (Martin).

5—Tridymite-Dinas bricks can be used at 1650 deg. C. for arches, etc.

IV. To obtain good hardness in fire bricks for high temperatures, the careful preparation of the raw material before the firing is of utmost importance and as little as possible physico-chemical action should occur during the last firing. The last firing is meant only to form a monolithe crystal from the grained material.

V. As the fire pots of forging and similar furnaces are corroded by weld-slag, they should not be constructed from firebrick but from quarz brick transformed into tridymite. For coke furnaces bricks with 40 per cent clay contents are used. Experience has shown that such bricks are least subject to attack from the basic slag of coke furnaces.

VI. Fire brick withstands sudden temperature changes well because it is a good heat conductor, which quality is greater the more homogenous the brick is. This can be secured by a good firing that transforms the various ingredients into one crystal agglomerate.

VIII. The destruction of furnace bricks through the Bell reaction, a crystalliztion of sooty carbon at low temperatures, can be partly counteracted by using a clay free from iron oxide and burning it to the full sinter point.

It is also advisable to compress the bricks as much as possible to make them non-porous.

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*Feurfest, 1925, Vols. I and II.

SHEET AND TIN PLATE

Trumbull Steel Breaks Another Record

Basic Open Hearth Furnace Produces 35,000 Tons in a Double Campaign

LAST winter the blast furnace fraternity were startled by the announcement that the new Trumbull Cliffs furnace had produced 25,000 tons of iron during the month of October and that a single day's tap, October 15, had exceeded 1,000 tons. For a furnace of 20.6-in. bosh diameter this was phenomenal, and the record still stands.

Early in February, 1925, Mr. James Frazier, superintendent of blast furnace, read a paper before the Eastern Association of Blast Furnace and Coke Oven Operators giving the details of his world's record run. To an assembly of leading operators, Mr. Frazier visualized his operation, and the results obtained, by means of very instructive and carefully prepared charts and comparisons. The characters of all ores, all limestones, all cokes were closely scrutinized and the highest recorded blowing pressures deeply impressed his audience. Careful control of all elements stood out.

In the discussion which followed, Mr. Jake Barrett of Ohio Works, Carnegie Steel, complimented Mr. Frazier, but concluded his remarks with the significant statement that "Ohio Works could probably do as well if they had the same equipment and the same control of raw materials." The obvious fact which the discussion brought out and which the record emphasizes is that *control* was and is the most important factor in this or any program or campaign involving metallurgical combustion.

At Trumbull Cliffs furnace, Mr. Frazier has very exact and continuous control, automatically, not alone of his turbo-blower volumes, but also of his burners on both blast furnace stove-burners and boiler-burners. (Incidentally this furnace exhibits the greatest excess power production per ton of coke charged known—is in other words a record heat balance blast furnace.)

Experience had proven to Mr. Frazier the value of automatic control. A record performance in one department of a large steel unit awakens the interest of all other departments. Why not the open hearth? The most natural suggestion was to apply the same reasoning and incidentally the same equipment—for in these problems the same fundamentals apply.

At Trumbull Cliffs control was effected by Steinbart burners on boilers and stoves and Huessner pres-

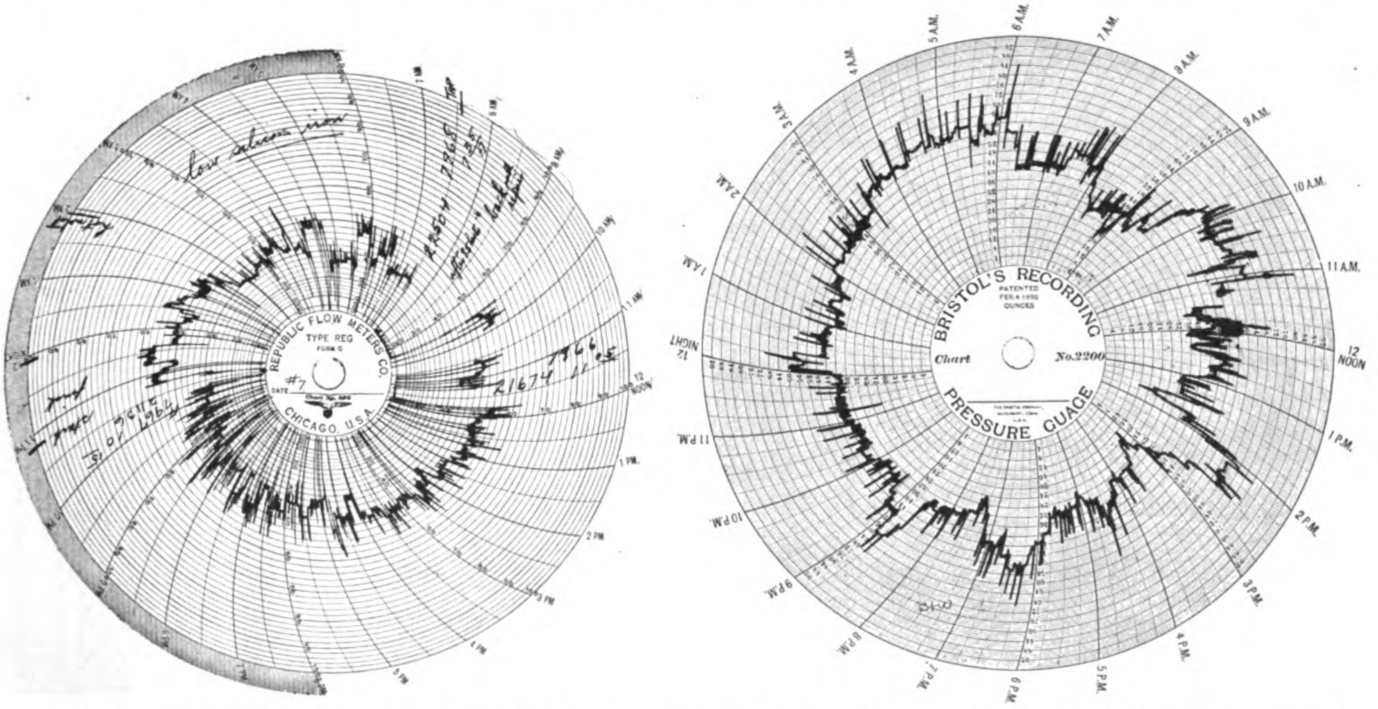

FIG. 1.—*The chart on the right was taken off the main gas header which supplies by-product gas from the coke-ovens to the open-hearth; note the variations in pressure during a typical 24-hour period. The chart on the left shows the range of gas flows which occur during the course of a heat; note the reduced flow after the melting down period. Regardless of the variations indicated the furnace pressure is maintained constant.*

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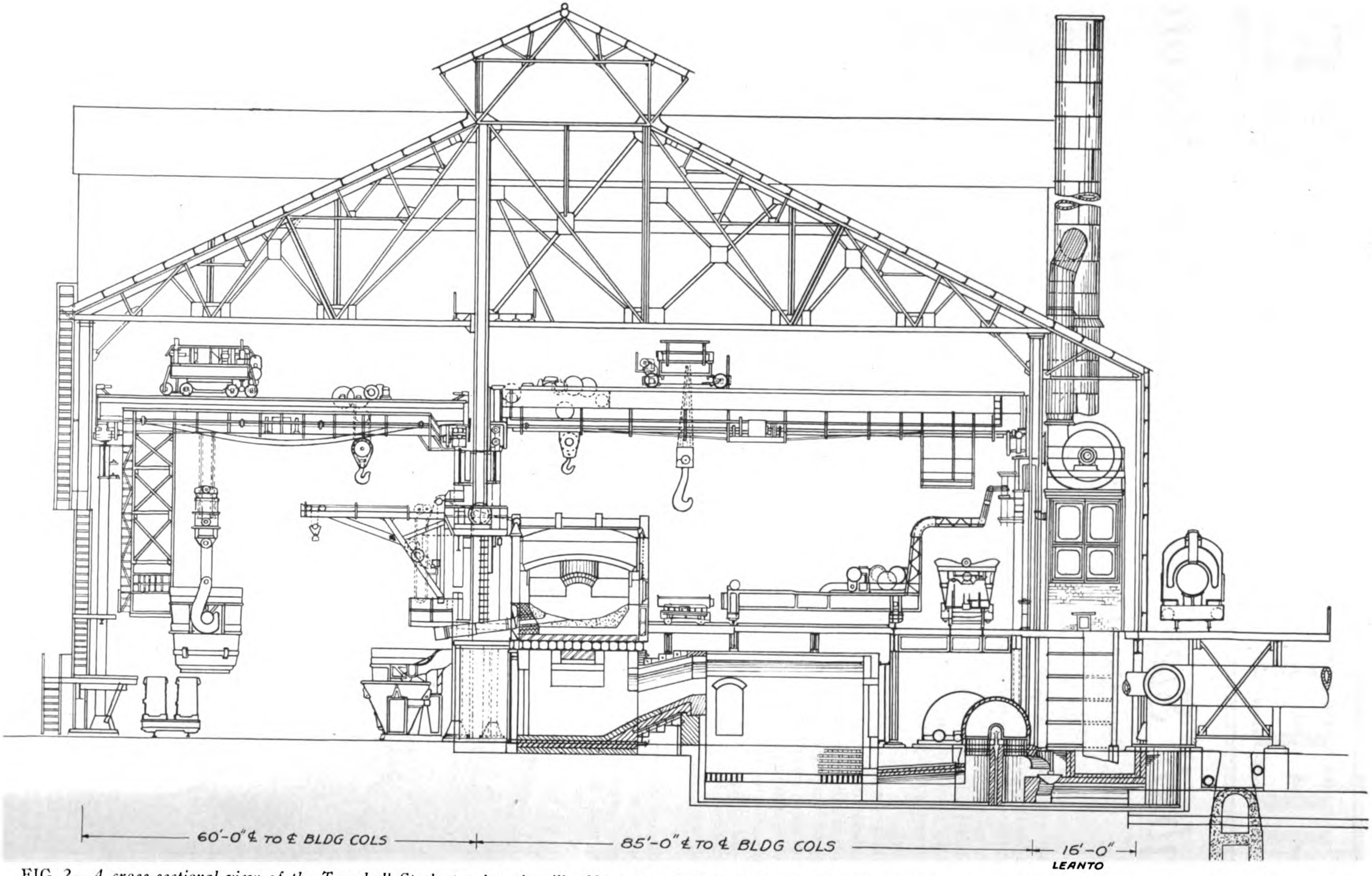

FIG. 2.—*A cross-sectional view of the Trumbull Steel open-hearth mill. Note the relations of the open-hearth furnace, the reversing-valves, fan-units and waste-heat boiler. There are seven* 100-*ton furnaces, designed for accessibility and economy of operation. Hot metal is received immediately from the Trumbull Cliffs furnace. Two of the open-hearths are now on by-product gas supplied from the company's own Koppers ovens. Two general weight of ingots* 20 *in. x* 22 *in. and* 24 *in. x* 27 *in. are cast. These are broken down in a* 40-*in. bloomer, which supplies slabs, etc., for the sheet and tin bar mills and for the strip mills.*

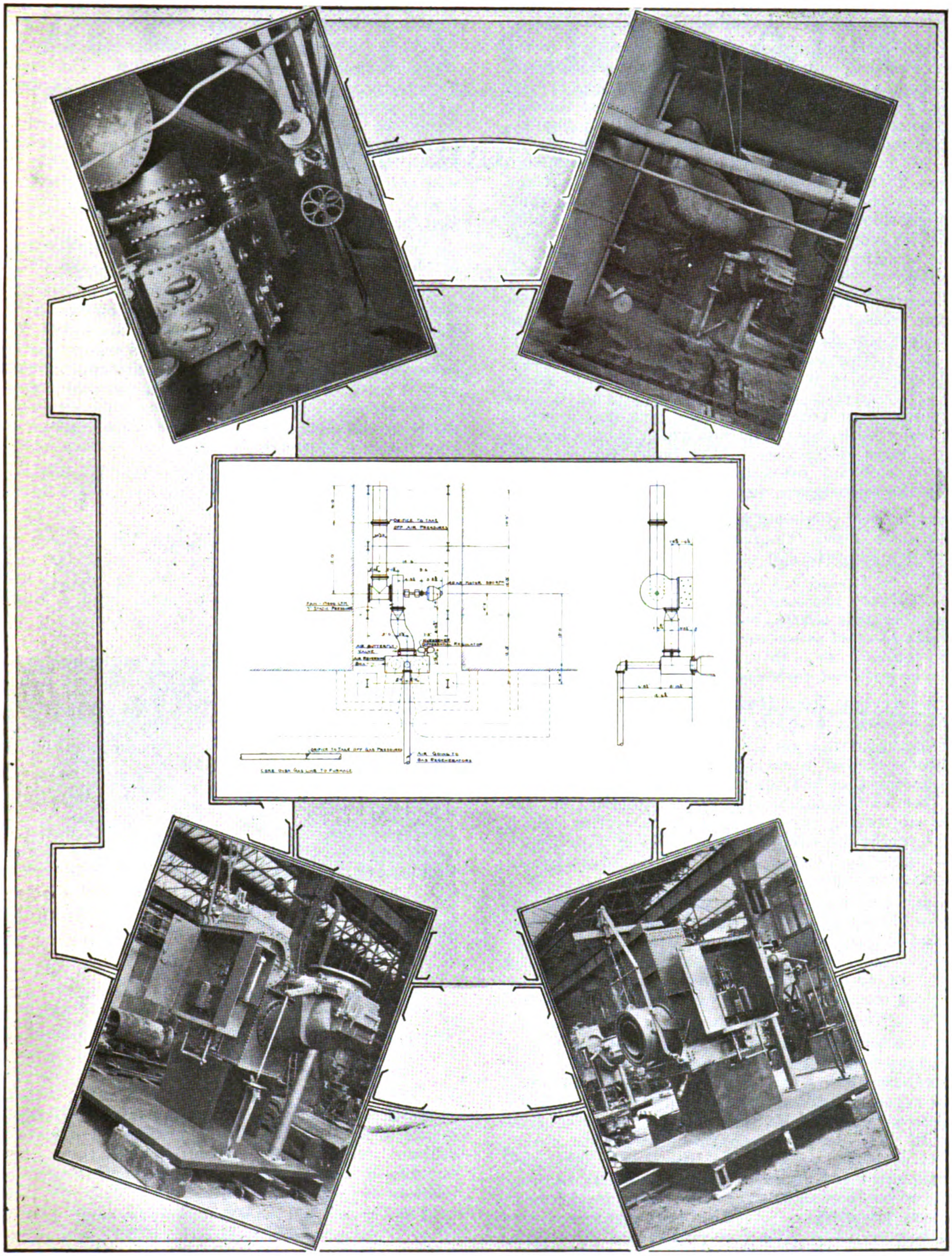
ORIFICE TO TAKE OFF AIR PRESSURE
AIR BUTTERFLY VALVE
AIR REVERSING BOX
DIFFERENTIAL REGULATOR
ORIFICE TO TAKE OFF GAS PRESSURE
AIR GOING TO GAS REGENERATORS
COKE OVEN GAS LINE TO FURNACE

FIG. 3—*An assembly of views showing various applications of automatic combustion controls. Upper left—Steinbart burners on the blast furnace gas fired boilers. Upper right—Controlled combustion of blast furnace stoves. Middle—Complete design of Trumbull open-hearth layout. Lower—Equipment under construction giving an excellent idea of the details.*

sure regulators on the turbo-blowers combined into the Huessner system of combustion control.

The same combination is now in operation on the 100-ton basic open hearth furnaces. On furnace No. 6, the second campaign is in progress. The first run recorded a gross tonnage of 30,000 tons of steel through the furnace. The furnace was taken off on Sunday, and put back into service on Thursday, a complete repair job in four days. Since the second campaign started, 35,000 tons of steel have been tapped out and evidences point to further service up to 40,000 tons. Average time of heats approximate 9 hours 10 minutes, with weekly runs of 14 heats consistently. This is on straight coke-oven gas, without tar or oil boosting.

The simplicity of the control is amazing. A Hagan furnace pressure regulator (double bell) connected on one side to the discharge of the motor driven blower, and on the other to the coke-oven gas main—controls a butterfly valve in the volume air supply (a 30-in. line). So sensitive to pressure fluctuations is this mechanism that regardless of the fact that a waste heat boiler with evacuating fan which results in constant suction differences in the boiler furnace, virtually a constant pressure condition is maintained within the open hearth furnace itself.

Nearly ideal combustion conditions are maintained. The furnace shows an apparent absence of flame with a high temperature and extremely high radiant heat transfer.

No furnace pressure charts are kept and no exit gas temperature charts, but frequent analyses of the products of combustion are made. Average analyses of exit gases from both coke-oven fired furnaces and producer gas-fired furnaces appear as follows:

Producer gas from Hughes producers furnish gas of the following analysis:

Experimentation on similar control equipment on the producer fired furnaces is now in progress. Variations in the fuel bed conditions within the producer itself render this combination rather difficult, but the same painstaking engineering and observation, which have brought the coke-oven gas problem within such close limits will surely prevail to the advantage of the producer units.

Much credit redounds to Mr. Mountain, superintendent of open hearth. Trained in the school of Gleason and Warren, while at Gary, Mr. Mountain properly evaluates the personal equation. Knowing the Warren brand of enthusiasm, which admist of nothing less than records and then more records, Mr. Mountain has given them records.

It is a safe assertion to make that when you hear of a record performance it was not a matter of chance. You can surely trace it directly back to a well balanced organization, and to an organization completely loyal to an enthusiastic general manager or superintendent. To such an organization, of which Trumbull is decidedly an example, the usual handicaps which confront a record performance seem nothing more serious than added incentive; every day becomes a record day to them. Where other great organizations have missed the mark in open hearth procedure, the fault has largely been a lack of sustained enthusiasm.

There is nothing new in forced draft application to the open-hearth. The idea has been in progress of development for many years; McCune, Egler, Danforthfi, Loftus, Isley have been written into it.

We have described these various mehtods of accomplishing this most desirable result. The idea of a complete system of controlled combustion as applied to the open-hearth, and the idea of so thoroughly imbuing the minds of the operating personel with the conviction that obvious advantages, metallurgically, are to be gained by controlling combustion, that they will enthusiastically stick to the job until the job is licked — that idea and combination is new. And just that has been accomplished at Trumbull.

We are indebted to Mr. Mountain, superintendent of Open Hearth, for the following data and details:

The by-product gas which is burned in No. 6 and No. 7 furnaces, comes direct to the open-hearth from the Koppers ovens operated nearby, through a 30-in. main gas line. Republic flow meters record the consumption, and pressure guages indicate approximately 2-in. main gas pressure. Huessner furnace pressure controls (double-bell, shown in Fig. 3) connected at the butterfly valve in 30-in. line maintain nearly a constant balanced furnace pressure.

Each furnace exists its combustion products to a waste-heat boiler, and temperature recorders indicate the waste gas temperatures.

The blowing equipment is divided between two types, a Sturtevant fan of approximately 25,000 cu. ft. capacity per minute, direct connected to a 40-hp. variable speed Westinghouse motor—and a Buffalo fan—General Electric motor combination of the same capacity.

Two other furnaces are on tar from the by-product, and three more on producer-gas, so that an unusual opportunity for fuel comparisons exist.

These comparisons appear as follows:

On straight tar the average consumption, without control is approximately 7,000,000 Btu. per ton.

On producer gas, approximately 550 lbs. coal, or slightly more than 7,000,000 Btu.

(Equipment is now being experimented with to effect the same control on the producer fired furnace. Preliminary stack gas analysis show: CO_2, 11 per cent; CO, 0 per cent, and O_2, 2½ per cent.)

Stack gas analyses from No. 7 furnace (controlled) during its second campaign (July 19) appear as follows:

	Time	CO_2	O	CO
Before hot metal.....	9.25	16.6	1.2	0.0
After hot metal......	9.40	17.2	1.8	0.0
	10.45	16.6	.8	0.0
Boiling lime	11.10	16.0	.6	0.0
	11.55	17.2	1.0	0.0
Shaping up	1.35	16.4	.6	0.0
Just before tap.......	2.35	16.8	1.2	0.0

Stack temperatures run from 1200-1300 deg. F. While these heat inputs per ton of steel indicate exceptional practice, they are borne out by results being obtained by another large steel producer using a combination of by-product gas and oil.

This gas-oil fuel combination averages 1,710,000 btu. of gas plus 2,650,000 Btu of oil, or a total of 4,360,000 Btu fuel.

In conclusion it may be well to mention that at Trumbull Steel open-hearth all checker-work is thoroughly well sealed against air infiltration.

THE SAFETY CRUSADE

Light and Vision

IN The Nela School of Lighting there is an exhibit showing a disc rotating at constant speed. Changing the amount of illumination on the disc apparently changes its speed of rotation. Under low illumination the disc appears to rotate rapidly; the geometrical patterns on its face are blurred and indistinct. When the illumination is increased there is apparently a pronounced slowing down of the disc, the patterns becoming distinct. The truth illustrated is fundamental: namely, that it takes less time to see under high illumination than under low—that there is a time factor in the process of seeing, just as there is a time factor in taking a photograph.

Saving time, crowding extra seconds into every minute, is the common objective of efficiency effort. We do it by substituting machinery for hands and orderliness for lack of system, but wherever human eyes are used, if the light is inadequate, the hour is not long enough for the work it should contain. The eye in its camera action is forced to take time exposures instead of snap shots. These exposures are taken thousands and thousands of times a day, and the extra fraction of a second for each exposure spells an accumulated loss of half an hour or so during the day.

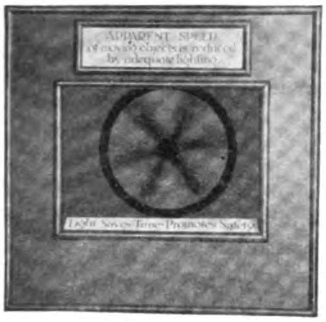
APPARENT SPEED
of moving objects is reduced
by adequate lighting
Light Saves Time-Promotes Safety

FIG. 1—*Under low illumination the disc appears to rotate rapidly.*

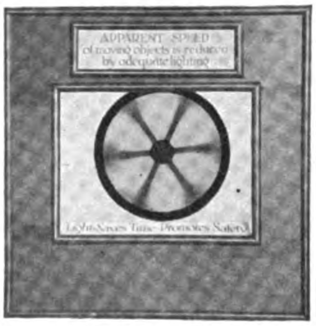
APPARENT SPEED
of moving objects is reduced
by adequate lighting
Light Saves Time-Promotes Safety

FIG. 2—*Raising the illumination apparently slows down the disc. In vision, light is time.*

Ample diffused illumination on the work saves this time; and with less, rather than more, effort on the part of the operator.

Good artificial illumination is a development of comparatively recent years, and although it is quite generally conceded to be desirable, there are few who entirely comprehend how the accompanying benefits are derived. The following curves present basic facts which provide a direct link between light and time—between better illumination and the increased production and decreased accidents, which have invariably resulted.

In addition, good lighting has numerous other advantages which cannot be expressed numerically, but which are none the less real and important. The marked improvement made in the general appearance of a room, the cozy comfortable atmosphere created in the home, the stimulating enlivening influence exerted in the store, the office and the shop—these are valuable by-products of proper illumination.

Perception.

Figure 3 shows the relation between the level of illumination and the simplest visual operation—perception. This curve illustrates the outcome of a series of tests in which a black dot was exposed momentarily on a white field, and for each level of illumination the shortest exposure was found for which the subjects could detect the mere presence of the dot. The curve shows that at 2 or 3 foot-candles, which is a common value of artificial interior illumination, a relatively long time is required for perception. With an illumination of 10 to 20 foot-candles, which now represents very good practice, the time required for perception is much less, and it decreases steadily as the illumination is raised still further. This is to be expected, since the range of outdoor illumination to which the eye has become accustomed through centuries of evolution is usually from 100 foot-candles, which corresponds to the waning illumination at sunset, to 10,000 foot-candles on a bright summer day.

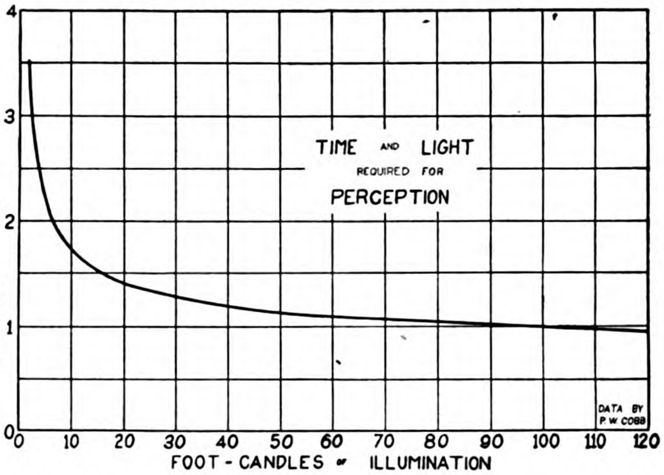

FIG. 3—*To perceive the mere presence of a black dot or a white background, it will be noted that the eye requires 3½ times as long under 2 foot-candles as under 100 foot-candles.*

Discrimination.

Good vision requires more than the mere perception of an object; it requires the discrimination of its fine details as well. The speed with which this discrimination can be accomplished—or in other words, the speed of vision—involves all factors of light and lighting which influence the ability of the eye to distinguish details by differences in brightness and color. Tests similar in character to the "perception" tests, have been conducted on the relation between the time required for discrimination and the amount of illumination. The results show the same general trend as that noted in the curve of Fig. 3 the eye discriminates details more rapidly under the higher levels of illumination, although requiring more time than for mere perception.

In all these basic tests it should be remembered that if the contrast between the test objects and their backgrounds were less pronounced than black on white a much higher illumination would be required to give the same clearness and quickness of vision.

The Astigmatic Eye.

Further tests have proved that an astigmatic eye always requires longer for discrimination—for vision—than does a normal eye under the same illumination. The curves in Fig. 4, covering the more common intensities of artificial lighting, show this to be the case. They also show that an increase in illumination benefits the astigmatic eye to a relatively greater extent than the normal eye, or conversely, at the lower levels of illumination the astigmatic eye is handicapped even more than the normal eye. This fact is especially worthy note, because more than half of the industrial workers of today have defective vision.

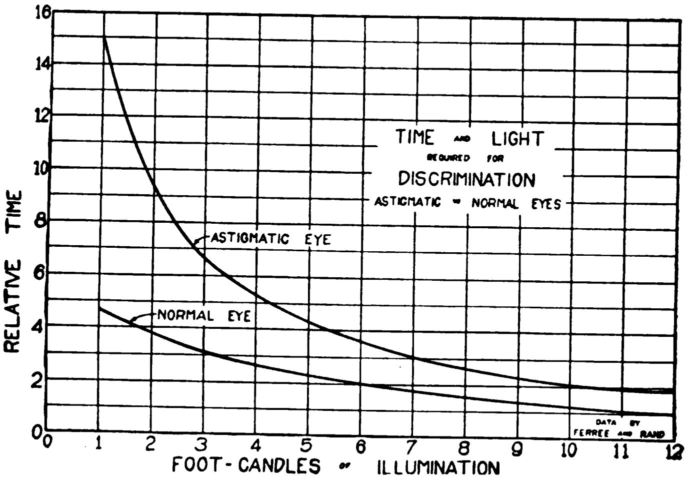

FIG. 4—*Higher illumination decreases the time required for vision, and lessens the handicap of astigmatism.*

Reading Test.

The practical value of these results has been verified by a test on the speed of reading, shown in Fig. 5. As would be expected, the time required to read 100 words becomes appreciably less as the illumination is raised. It will also be noted that reading was faster with a sharp contrast between the type and its background. This latter fact is significant, since in the everyday uses of the eye, with the single exception of the printed page, brightness contrasts are seldom found as pronounced as black on white, which is the best condition for clear vision.

Eye Fatigue.

It is a common experience that under a continuous gaze the eye becomes fatigued to such an extent that the details of the object viewed become blurred part of the time. Fig. 6 shows the results of tests which have established the fact that under low illumination a fixed gaze fatigues the eye rapidly, whereas raising the illumination improves the clearness of sustained vision to a considerable extent. Here again the astigmatic eye is handicapped even more than the normal eye by insufficient illumination.

Glare and Vision.

The foregoing tests have demonstrated rather conclusively that by increasing the quantity of light the speed and accuracy of vision are increased. This is only true, however, where the eyes are not subjected to glare. It is generally known that the pupil—the gateway of vision—contracts very much when the eye is exposed to glaring light sources, but the practical effect of this contraction, which is Nature's safety valve, is usually overlooked.

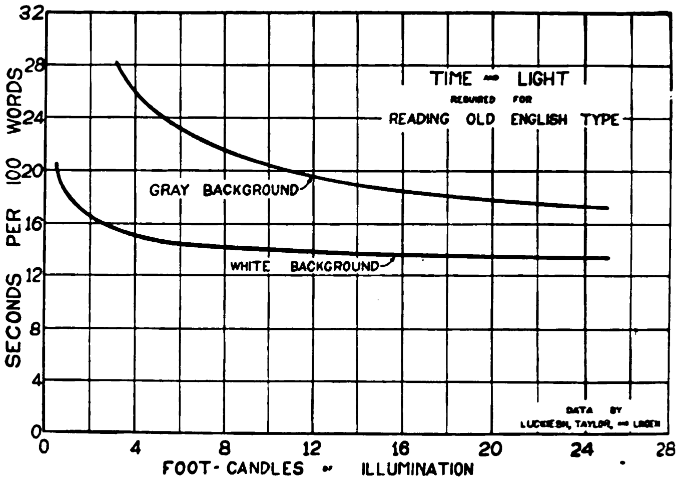

FIG. 5—*The time required for reading decreases as the illumination is raised, and is less with a sharp contrast between type and paper.*

When one looks at an object, an image of the object is formed within the eye, and nerves transmit the picture to the brain. The fundamental factor in vision is the brightness of this image, which is proportional to the area of the pupil and to the brightness of the object viewed. In the absence of glare the pupil automatically expands, which is equivalent to increasing the illumination on the object viewed.

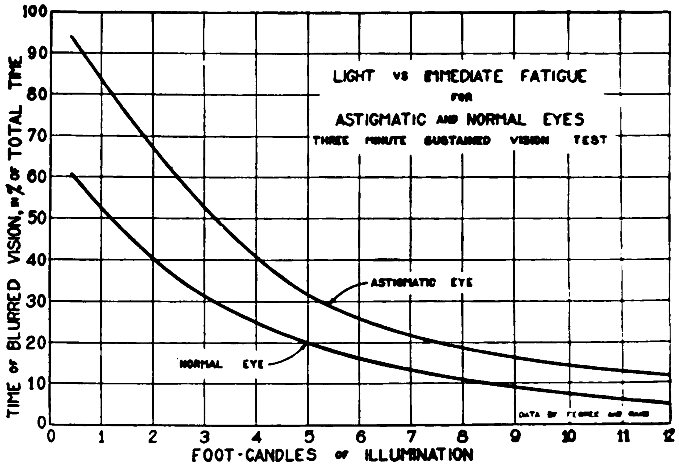

FIG. 6—*Raising the illumination reduces eye fatigue, as measured by less blurring of sustained vision.*

To illustrate this point, suppose a workman has 10 foot-candles upon his work, but the lighting is so glaring that his pupils are contracted to a diameter of ⅛ in. A second workman also has 10 foot-candles upon his work, but the lighting units are of proper design and are hung well out of his direct line of vision, so that the absence of glare allows his pupils to expand to 3/16 in. The brightness of the image within the eye being proportional to the square of the diameter of the pupil, the images of the second workman will be about twice as bright as those of the first workman. Even though the intensity of illumination at the work is exactly the same in the two cases, the second workman is really enjoying the advantage of twice as much "seeing" light. His visual doorway is open a hundred per cent more than that of the first workman exposed to glare. There are other beneficial results arising from elimination of glare, such as greater comfort and safety, but the one just stated is directly measurable in terms of foot-candles.

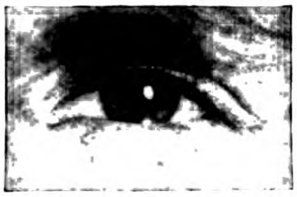

FIG. 7—*Pupil contracted by a glaring light source, as in Fig. 9.*

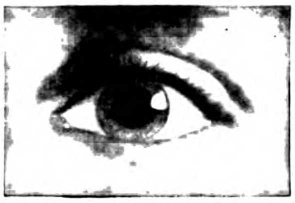

FIG. 8—*Pupil expanded under proper lighting, as in Fig. 10.*

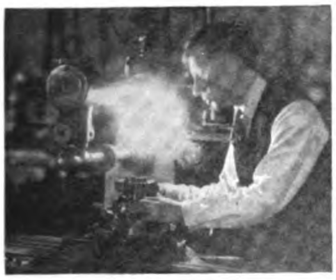

FIG. 9—*Bad practice—a glaring local light causes poor vision, eye-strain, fatigue, and danger of injury.*

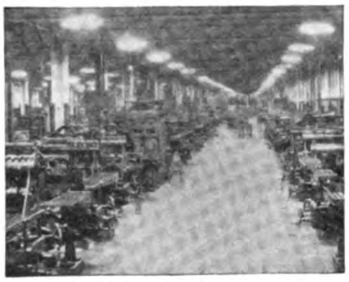

FIG. 10—*Good practice—uniform well-diffused illumination results in good vision, comfort, and safety.*

Illumination and Production.

These studies of the fundamentals of light and vision have a very practical value in pointing the way toward increased productiveness in industry, and in other fields. Tests have been run in a number of industrial plants to determine the relation between illumination and production, other factors being kept constant. In every case, increasing the illumination has increased the production far beyond the added lighting cost.

One such investigation was completed not long ago in the Inspection Department of the Timken Roller Bearing Company at Columbus, Ohio. The number of bearings inspected per operator per hour was found, first under the old lighting system providing an average of about 5 foot-candles on the work, and then under well-designed systems providing 6, 13, and 20 foot-candles. Unusual care was taken to prevent any factors other than illumination from influencing the results. During the ten weeks of the test the humidity and the interior temperature were kept practically constant, and the employees did not know their production was being investigated.

The results of the test furnish proof that for the class of work carried on in the Inspection Department investigated the production is materially affected by the illumination supplied. Without exception, the production increased when the illumination was raised and decreased when it was lowered.

Under the old glaring lights, which gave only about 5 foot-candles on the work, the number of pieces inspected per operator per hour was 408. Under a well designed system providing 6 foot-candles, with a minimum of glare and objectionable specular reflection, the number of pieces inspected per operator per hour was 424, representing a 4 per cent production increase over that obtaind under the former faulty illumination of about the same foot-candles. Likewise, increasing the illumination from 6 to 13 foot-candles with a well designed system resulted in an output of 440 pieces per operator per hour, representing a further 4 per cent production increase, and when the illumination was raised to 20 foot-candles, the production increased to 458 pieces per operator per hour, which was an additional 4.5 per cent increase. Thus, comparing the 20 foot-candles system with the one originally in use, a 12.5 per cent increase in production is found.

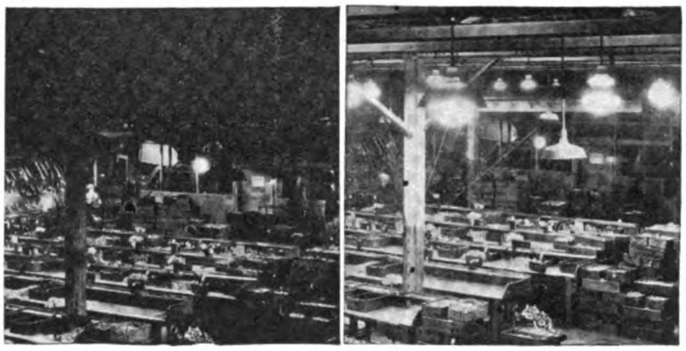

FIG. 11—*Old and new lighting systems, under which the effect of illumination on production was tested.*

Economics.

Fig. 13 (not shown) shows the production increases obtained by raising the illumination, as compared with the added cost of the better lighting.

The cost figures for the Timken installation are:

Cost of lighting (current, lamp renewals, fixed charges, etc. new 20 foot-candle installation	$ 0.32 per hour
Cost of lighting, old 5 foot-candle installation.	0.04 per hour
Added cost of better lighting................	$ 0.28 per hour
Hourly total wages of 44 inspectors........	13.20 per hour
Hourly saving to Company through a 12½% production increase.......................	1.47 per hour

Thus the saving to the company is over five times the added cost of the better lighting.

Illumination in Other Fields.

Though the foregoing tests on the fundamentals of light and vision have been here linked with production in the industrial field, clearly they have the same significant bearing on the efficiency of all other kinds of work. Consequently best results in offices, schools, drafting rooms, etc., can be obtained only where the deficiencies of daylight are met by inadequate illumination.

In addition to assisting the worker, good lighting has powerful beneficial influences in other phases of everyday life. In the commercial field, the attracting power of the brightly-lighted show window has been demonstrated repeatedly, and within the store good illumination not only assists the customers in selecting the merchanidse wanted, but its cheerful atmosphere builds good will and stimulates the desire to buy.

Insufficient illumination is the direct cause of over 17 per cent of the night traffic accidents. Adequate street lighting avoids this loss(besides decreasing crime, facilitating traffic movement, and generally arousing civic pride.

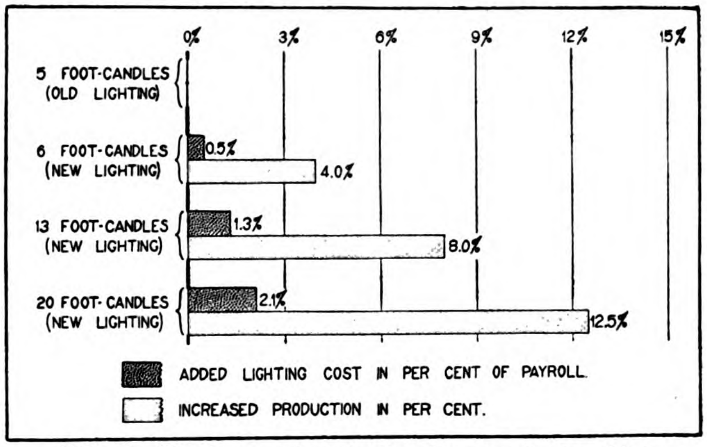

FIG. 12—*The increased production far exceeds the added lighting cost.*

To assist the 30 per cent of the school children who have defective vision, and to prevent astigmatism caused by eye-strain the, school and the home should have ample light. In addition, the home may be greatly beautified by the use of light for decorative effect.

On the following page are shown typical installations of good illumination for the store, the office, the home, the school and the street.

Utilization of Blast Furnace Gases

By A. C. Blackall*

Considerable interest attaches to the building of the largest gas engine ever produced in England, if not in the world. It has been under construction for some nine months past at the Devonshire Works of the Staveley Coal & Iron Company near Chesterfield. The engine was formally started last week and is driven by blast furnace gases and is connected by a 5,000 kw. alternator. The Staveley Company are the principal suppliers of electricity to the entire district surrounding their works.

The company started their electrical business on a large scale 25 years ago, and now have some 50 miles of overhead high-tension cables. They are supplying nearly 900,000 units of electricity per week, and in the near future they will be developing over 1,000,000 units weekly. This, said Mr. Markham, very nearly brings the plant up to the capacity of Leeds, and they were turning out more electricity at Staveley than the huge generaing station a Rotherham. The price at which Staveley was selling electricity was about 1d (2 cents) per unit; in some cases it came down to 0.4d and 0.5d. They were able to supply current at these low prices solely because of the utilization of blast-furnace gases.

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*London, Eng.

F. E. Mesta

Mr. F. E. Mesta, president and general manager of the Mesta Machine Company, Pittsburgh, Pa., died suddenly August 31, at his home.

He received his early education in the public schools of Bethel Township, Allegheny County, Pa., and graduated from the High School of Leechburg, Pa. His practical experience in the iron and steel business was obtained in the plant of the Leechburg Foundry & Machine Company, Leechburg, Pa. He later took up engineering and went into the engineering department of the Leechburg Foundry & Machine Company; afterwards, going on the road as selling representative of this company, as well as having charge of their outside erecting work.

F. E. MESTA

In 1898, he took charge of the construction of the present plant of the Mesta Machine Company, at West Homestead, Pa., and was made general superintendent when the plant was put into operation.

In April, 1912, he was elected director and vice president of the Mesta Machine Company, in charge of operations, which position he held until his recent election as president and general manager, after the death of his brother, Mr. George Mesta.

Store Your Coal Now

Wherein Is Given Some Pertinent Facts Regarding Existing Conditions and a Discussion of Ways and Means for Storing Bituminous Coal

By RUSSELL BYRON WILLIAMS*

SECRETARY HOOVER says: "The fall car shortage has the effect of increasing the price of coal and seriously disturbing the whole economic machine. Security lies in repeating the storage performance of last year, by the manufacturers of the country taking reserves of coal during the summer months, thus foregoing the necessity of coal shipments during the peak period in competition with household movement, grain and fruit shipments. * * * *

There is, therefore, every transportation and financial reason for storing coal during the summer months in preparation for the autumn and winter need. It would be a contribution not only in the interest of the consumer but of the railways and the coal industry."

Floyd W. Parsons, nationally known writer, says: "Store your winter requirements of coal before September first. Today mine operators are selling their products at a virtual loss. There is nothing to be gained by delaying the purchase of coal until winter sets in."

Owen Meredith Fox, editor of the Black Diamond, says: "Prices of all coals are lower today than at any time during the past seven years. A year ago last January smokeless mine-run was selling at $8.00 a ton. Today the market price is about $2.00 the ton. Coal production costs vary from $1.25 to $2.25 a ton, depending upon operating conditions and labor costs. Prices for industrial coals range, at the present time, from 90 cents to $2.00 a ton.

Probably out of the 700,000 bituminous miners not more than 200,000 have worked on any given day in the past two months. The great majority of the 500,000 miners have been out of work steadily throughout the months of May and June. Illinois and Indiana operations are running now at about 17 per cent of capacity. Ohio and Western Pennsylvania at about 15 per cent, with the non-union fields, south of the Ohio River doing a little better — about 20 to 50 per cent.

One coal company owning 12 mines is trying to keep five of them under production. During May and June they averaged 1½ days operation out of every week. At present, over 140 coal companies are in the hands of receivers."

Thus we see and appreciate the need, not only for ourselves, but for the coal industry, the railroads and the household consumer's pocket book, for storing our winter's coal requirements now. With that recognition we turn to the consideration of coal storage—how to store coal economically.

Five Accepted Methods.

There are five accepted methods for storing coal. These are:

By means of locomotive cranes.
By means of bridge tramways.
By means of the Dodge Coal Storage Systems.
By means of the drag-scraper.
By means of portable belt conveyors.

The second and third methods, that of bridge tramways and the Dodge System are employed only where large tonnage is required. For this reason, their application is more or less limited and need not enter into this discussion. To the end of illustration, however, the two methods are pictured in accompanying photographic reproductions.

Locomotive cranes are universally employed for coal storage because of their wide range of usefulness. The locomotive crane selected is usually of standard gauge and for unloading coal from gondola cars to storage piles. Cranes of this type are usually fitted with booms up to 50 or 60 feet in length and equipped with clamshell buckets ranging from one to two yards in capacity. They will unload coal from cars at the rate of 50 to 70 tons per hour, depending upon local conditions. Such cranes weigh from 130,000 to 200,000 pounds and are known as 15 to 30-ton cranes, this designation referring to the capacity of the crane when the boom is at its minimum radius. Only two men are required for the operation of such cranes, which small labor requirement makes this method of storing coal usually the most economical.

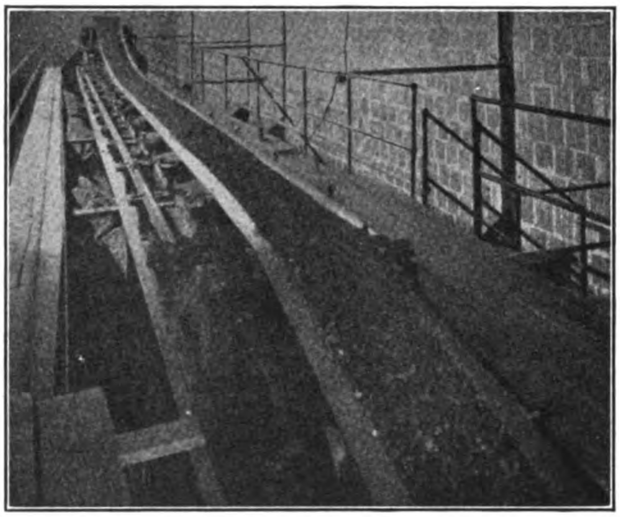

FIG. 1—*Example of very long horizontal coal transfer belt.*

It is quite impossible, of course, to give definite figures covering the cost of handling coal with a locomotive crane. Too much depends upon conditions—how much coal is to be handled, what tonnage is to be handled in a given time, what tonnage requires rehandling, etc. However, it can be said that in handling a volume of 50,000 tons (which is roughly 1,000 cars, or 20-25 cars per week) with a 20-ton crane equipped with a 50 ft. boom and a 1½ yard bucket (which represents an investment of not more than $14,000) the operation costs would be about as follows:

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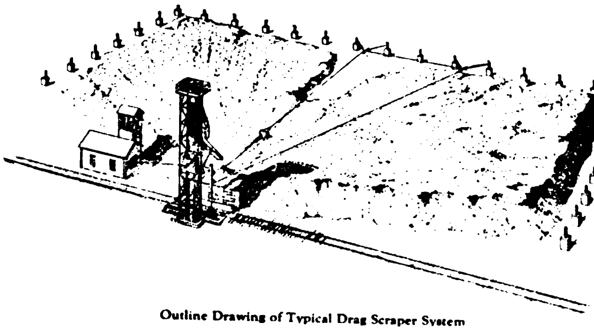
*Chicago.

Interest on investment, 7 per cent	$ 980.00
Depreciation and repair at 12½ per cent	1,750.00
Fuel, oil, etc., 200 days at $6.00	1,200.00
Operator, 200 days at $6.00	1,200.00
Helper, 200 days at $4.00	800.00
Total cost with crane	$5,930.00

This, total, considering the tonnage handled, makes the handling costs 12c the ton.



Outline Drawing of Typical Drag Scraper System

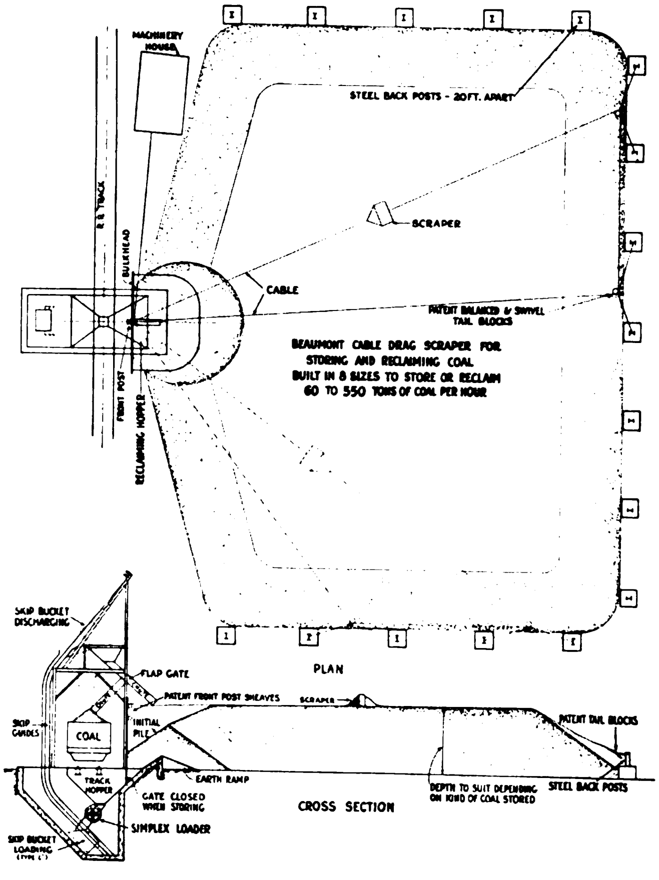


FIG. 2— *A diagramatic layout showing the possibilities of the drag-scraper.*

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Another suppositious case: A manufacturer consuming 75,000 tons of coal annually and who finds it necessary to store out one third of it (25,000 tons), thus handling a volume of 100,000 tons a year. Here, the tonnage has been doubled, yet the handling costs will be found lower per ton. For, in this instance, it would be necessary to work the crane 300 days the year with two helpers instead of one.

The total operating costs would then be:

Interest at 7 per cent per year	$ 980.00
Depreciation and repairs at 12½ per cent	1,750.00
Fuel, oil, etc., 300 days at $6.00	1,800.00
Operator, 300 days at $6.00	1,800.00
Two helpers, 300 days at $4.00	2,400.00
Total crane operating costs	$8,730.00

Thus we see, in this instance, 100,000 tons of coal handled during the year at a cost of about 8½c or 9c the ton.

A typical coal storage, using locomotive cranes for storing out and reclamation, has been employed by a large power company. The storage is that of the Philadelphia Electric Company and the quantity stored ranges from 80,000 to 125,000 tons. It is of interest to know that bituminous coal is here stored out from cars to a height of 30 feet and allowed to remain in storage for a long period of time — without the slightest danger of spontaneous combustion. This risk is eliminated by the simple process of rolling the coal with a crawler tread tractor and a one-ton roller. As the coal is stored out, it is laid rather evenly over the entire pile in layers of from three to four feet deep. Each layer is then thoroughly rolled with a large roller drawn by a crawler tractor. This method seals the coal and prevents the entrance or circulation of oxygen. It has been found that this is an effective preventative against spontaneous combustion, as coal has, on occassion, been allowed to remain in storage as long as two years without disturbance and with no sign of combustion or internal heat.

Storing Coal With Power Hoe.

For somewhat smaller storage, a very simple and inexpensive way to handle stored coal is that of employing the power hoe or drag scraper. Fig. 2 shows a typical installation of the power hoe. The coal is received in railway cars, dumped into a portable belt conveyor which discharges it to the initial pile alongside of the railroad track. The hoe is moved to and fro by a steel cable, the ends of which are fastened to driving drums in the operator's house, which is so arranged as to give a full view of the entire storage. The cable passes around sheaves so located as to serve the storage yard at intervals of about 20 or 30 feet. Thus the power hoe takes the coal away from the initial pile, placing it on that portion of the pile which can more easily bear additional tonnage. The empty hoe rides on top of the coal until it returns to the initial pile and the cycle of operation is repeated.

When reclaiming from storage, the hoe's attachment to the cable is reversed, thus moving the coal in the opposite direction. Where conditions permit the power hoe can be used in connection with a crane, the boom being used to answer the purpose of the driving drum. This method is illustrated by the line drawing in Fig. 2.

Storage for Small Industries.

Because the storage of coal is largely a matter of facilities, there are, here and there, factories that find it impossible to store coal in quantities to cover an entire winter's requirements. Furthermore, it is characteristic of Americans to look at the ostentatious installation and to talk of the "big" things. Perhaps because of this fact, many who are in a position to profitably store a limited supply of coal, hesitate doing so because of the erroneous belief that by so doing large investments and complex systems would be entailed. To overcome, in some measure, this erroneous belief, we cite an instance of more modest character, and which shows the practicability and prove the economy effected through the storage of a limited supply of coal.

An industrial concern in Ohio uses 4,500 tons of run-of-mine, bituminous coal a year. The factory has but a limited amount of space on which to store their coal. They keep several hundred tons on hand.

During the war they found that it was costing about 35 cents a ton to unload, pile and reclaim this coal. This they felt to be entirely out of proportion to its value and began an investigation of a system of coal storage that would handle their volume of coal more economically.

In the discussion of ways and means, the Link-Belt Company prepared a practical plan which included, as the entire equipment involved, a standard portable belt conveyor. The plan was adopted and a 31 foot machine was installed and put into operation. This conveyor, at an angle of 30 deg., will pile 13 ft. 6 in. high, but as is shown in the accompanying drawing, the conveyor was lowered so that it piles but to a height of eight feet. This low height prevents burying the wheels of the portable conveyor. The machine is capable of swiveling — which enabled it to serve an arc about 36 ft. long, with a minimum handling of the machine. Thus an arc 8 ft. high and 36 ft. long gives a storage of about 70 tons. The drawing shows how the portable belt conveyor backs away from the pile as the coal is stored out.

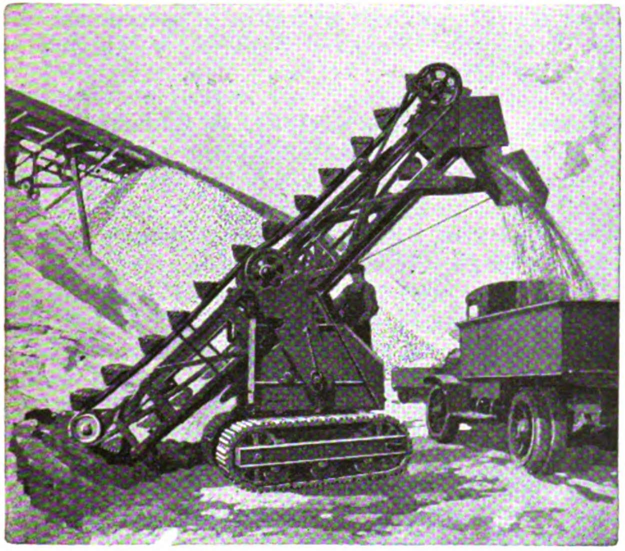

FIG. 3—*Shows a tractor-portable belt unloader working into a truck.*

In actual operation this plan and equipment worked out about as follows:

Fixed charges per year:	
Depreciation at 20 per cent (conservative)	$208.20
Interest on investment of $521 at 6 per cent	31.26
Upkeep — repairs, oil, etc.	50.00
Power (electric) required	25.00
	$314.46
Labor charges:	
2 hrs. per car (assume 90 cars) at .50	90.00
Total cost of storing coal	$404.46

Compare this figure, of a little less than 9c the ton with the pre-war hand method which cost 35c the ton. This is a saving of 26c the ton, for a volume of 4,500 tons, which is certainly more than enough to justify the cost of the portable belt conveyor and the small amount of ground space on which to store the coal.

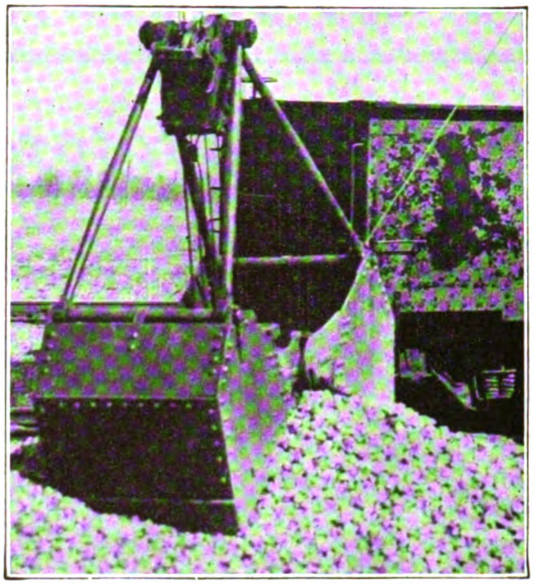

FIG. 4—*A typical example of the usefulness of the big bucket.*

In the words of Floyd W. Parsons: "There is nothing to be gained by delaying the purchase of coal.

Industrial Health Important

The active co-operation of an increasing number of industrial plants in public health efforts is largely responsible for the decreasing death rate and the higher health level obtaining virtually all through the country, in the opinion of the medical director of one of the biggest insurance companies. He says since leaders of industry recognized the fact that community health is national and economic wealth that the public health movement has made itself felt in a more appreciable way.

"Education in public health work is a slow process and must be disseminated to groups if we expect to see the results in our time," said Dr. J. Allen Patton of the Prudential Insurance Company. "Medical inspection of children in schools reveals defects that would take years to discover without this community supervision. Medical examinations of men and women in business organizations bring to light physical impairments that handicap them not only in their work, but which if neglected will shorten their lives. These people would never respond to any warnings as individuals. They must be reached as groups.

"An effective industrial welfare department assures supervision of the health of a large percent of the community in a manufacturing town. The indirect influence reaches into the family of each employe. The plant personnel becomes a cohesive body for any social or sanitary improvement public spirited citizens may try to achieve.

"Examinations required for employment are seldom severe, yet they are usually sufficient to detect any serious organic disorder. In that respect they are of benefit to the applicant, who may in this way learn of an im-

(Continued on page 367)

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CURRENT REVIEW

Current Literature on Ferrous Metallurgy

By E. H. McCLELLAND*

Aenderung der festigkeitseigenschaften überwiegend perlitischer stähle durch wärmebehandlung. H. Meyer and W. Hesseling. *Stahl u. Eisen,* v. 45, July 9, 1925, p. 1169-1173.

Application of blast furnace gas and air for blowing a gas producer. G. R. McDermott. *Iron and Steel Engineer,* v. 2, July 1925, p. 269-273.

Automatic blast furnace. Frank W. Cramer. *Iron and Steel Engineer,* v. 2, June 1925, p. 229-242.

Balance reactions in steel manufacture. A. McCance. *Iron and Coal Trades Rev.,* v. 110, June 19-26, 1925, p. 1002-1004, 1038-1040.

Beitrag zur analytischen chemie wolframhaltiger stähle. Felix Fettweis. *Stahl u. Eisen,* v. 45, July 9, 1925, p. 1109-1110.

British rolling mill practice. Thomas W. Hand. *Iron Age.* v. 116, July 23, 1925, p. 213, 254-256.

Deoxidation of steel. Cecil H. Desch. *Foundry Trade J.,* v. 31, June 4, 1925, p. 478-480.

Develop electric furnace for foundry. *Iron Trade,* v. 77, July 9, 1925, p. 69, 105.

New type installed in foundry of Bingham & Taylor Company, Buffalo.

Eight-inch merchant bar mill; continuous and looping trains of the Donner Steel Co. at Buffalo; sections and speeds indicated. *Iron Age,* v. 116, July 23, 1925, p. 201-204.

Efficiency of heating furnaces. E. H. Koenig. *Iron Trade,* v. 77, July 30, 1925, p. 249-253.

Compares performance of continuous and intermittent types.

Electrical driving in a constructional steel works. *Iron and Coal Trades Rev.,* v. 111, July 17, 1925, p. 98.

Elektrochemische verhalten der nichtrostenden stähle. B. Strauss. *Stahl u. Eisen,* v. 45, July 9, 1925, p. 1198-1202.

Experiments in the manufacture of chilled iron rolls. Archibald Allison. *Foundry Trade J.,* v. 31, June 4, 1925, p. 481-483; v. 32, July 9, 1925, p. 27-30.

Fuel application; the essential factor in furnace design. E. J. Evans. *Iron and Steel Engineer,* v. 2, June 1925, p. 263-266.

Future of wrought iron. *Iron and Coal Trades Rev.,* v. 111, July 17, 1925, p. 94-95.

Heat-resisting cast iron. Andre Levi. *Foundry Trade J.,* v. 31, June 25, 1925, p. 549-554.

Heat treatment of cast iron. Fred Grotts. *Trans. A. S. S. T.,* v. 7, June 1925, p. 735-742.

Heat treatment of high speed steel dies. C. B. Swander. *Trans. A. S. S. T.,* v. 7, June 1925, p. 727-734. *The same. Forging,* v. 11, July 1925, p. 238-240.

Insulation of hot surfaces and furnace walls. L. B. McMillan. *Iron and Steel Engineer,* v. 2, July 1925, p. 301-310.

Investigation of a method for the sampling of coal cargoes. F. H. Walker. *Chem. and Ind.,* v. 44, June 12, 1925, p. 283 T - 285 T.

"Bibliography", p. 285 T.

Large uses of steel in small ways; notebooks. *Iron Trade,* v. 77, July 9, 1925, p. 78, 111-112.

Large uses of steel in small ways; watch hands. *Iron Trade,* v. 76, June 25, 1925, p. 1634, 1641.

Leistungsfähigkeit von konverteranlagen. E. Herzog. *Stahl u. Eisen,* v. 45, July 9, 1925, p. 1122-1125.

Low-temperature heat treatment of special cast irons. J. W. Donaldson. *Foundry Trade J.,* v. 31, June 18, 1925, p. 517-522.

"Bibliography", p. 522.

Making cast stainless steel. J. M. Quinn. *Foundry,* v. 53, July 1, 1925, p. 515-518, 525.

The same. Iron Trade, v. 77, July 23, 1925, p. 185-188, 225.

Malleable iron. F. H. Hurren. *Foundry Trade J.,* v. 31, June 11-18, 1925, p. 499-502, 526.

Manufacture and heat treatment of large forgings. A. O. Schaeffer. *Trans. A. S. S. T.,* v. 7, June 1925, p. 699-717.

Mechanical and physical properties of cast iron. Part 1. J. E. Hurst. *Foundry Trade J.,* v. 31, June 25, 1925, p. 545-548; v. 32, July 9, 1925, p. 31-32.

Neuerungen auf dem gebiete des schleudergusses. Carl Pardun. *Stahl u. Eisen,* v. 45, July 9, 1925, p. 1178-1180.

Notable blooming mill. W. H. Bailey. *Iron Age,* v. 116, July 30, 1925, p. 271, 320.

Abstract of paper before American Iron and Steel Institute. Deals with 44-inch mill at Homestead.

Note on the practice and purpose of perlit iron. Horace J. Young. *Foundry Trade J.,* v. 31, June 11, 1925, p. 503-506.

Origin of British ores traced. Edwin C. Eckel. *Iron Trade,* v. 77, July 9, 1925, p. 68-69.

Power generation by blast furnace plant. O. C. Callow. *Iron and Steel Engineer,* v. 2, June 1925, p. 242-246.

Present status of the laboratory investigation of sands. H. Ries. *Foundry Trade J.,* v. 31, June 11-18, 1925, p. 495-498, 523-525.

Production of castings with special reference to iron castings. Robert Lehmann. *Foundry Trade J.,* v. 32, July 9-16, 1925, p. 35-38, 53-54.

Reclaiming wobblers; several applications of arc welding for repairs in steel mills. R. L. Scollard. *Iron Age,* v. 116, July 16, 1925, p. 152-153.

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We Are Better Friends Now

By Eugene G. Grace*

When I started to work in the mills 20 odd years ago I realized that there was something lacking in the relations existing between the management or so-called "boss" and those of us who were trying to do our best for him. Our interests seemed entirely apart. Often we did not understand the reasons or need for actions which seemed unnecessary or repugnant to us.

This condition was one which followed a growth in the physical proportions of industry unprecedented in the world's history. Machinery had developed faster than the spirit guiding it. Men had learned to make more goods but not how to make them together in harmony.

You can neither understand nor come to a real understanding with people without talking to them. With the coming into existence of large corporations with stockholders, employees, directors and officers there came also a need for a development in human relations which would maintain the mutual understanding between these various branches of business.

Individual contact in large organizations is a physical impossibility. Much as they would like to, officers cannot maintain individual contact with thousands of stockholders and other thousands of employees.

Modern business has met the situation through the organization of representation plans not unlike those found in our system of government. Representatives of management and representatives of the workers meet together to exchange their respective opinions on all matters of common interest.

Between the management and stockholders liaison is established through reports mailed and printed in the daily press. Modern periodicals aid in maintaining the liaison by publishing reviews of various business enterprises.

Today industry is managed largely by men who have come up through these great mills and shops during the last 30 years and who thus understand the point of view of the men doing the physical work. And understanding that point of view they have taken steps to meet it.

Men want to be treated like the human beings they are, with a voice in determining their working conditions. They want some understanding of whys and wherefores. They want some provision against the future and against sickness and accidents, which unfortunately are unavoidable. They want pay consistent with the kind and amount of work they are doing and a system of pay which allows them to earn and rise on their merits.

Modern industry today is working towards providing for these wants. In practically every state industry is required by law to care for employees who are injured. Provision is made to care for employees who are sick. Workers who have passed their best days laboring for industry are provided with pensions to help toward maintenance in old age. Industry sees to it that workers have an opportunity to practice thrift and have good living conditions and helps them finance the purchase of their own homes. The tendency in modern industry is distinctly towards paying men on incentive or production bases which allow each man automatically to share in the profits of business.

I believe that the outstanding accomplishment of the present era has been the betterment which has taken place in the field of human relations. Not only have I witnessed with much interest the progress which has been made in this regard in industry at large, but for a number of years I have had the keen satisfaction of observing the splendid results of the application of these broad principles within our own organization. Since the establishment some years ago of a plan of representation in our plants we have been gratified to note the increased interest the men are taking in every part of the business. Periods of unemployment are being reduced through the efforts of the men. The quality of work is improving. Suggestions for safety provisions are coming from the men as well as suggestions for ways of increasing actual production.

The whole tendency of modern business is to avoid and eliminate waste. Past years have seen the elimination in large measure of the great waste which accompanied hand labor. Today we are seeking the elimination of that waste which comes from lack of understanding of and interest and harmony in work.

Today the various parts of industry realize more than ever their mutual interdependence, and realizing that fact they are taking steps to make each man understand the work and problems of his neighbor.

—Bethlehem Bulletin.

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*President, Bethlehem Steel Corporation.

The Institute of Metals

The programme of the annual autumn meeting of the Institute of Metals, which has just been issued, is an attractive one. Held in Glasgow, the meeting begins on September 1 with a lecture by Sir John Dewrance, K.B.E., on "Education, Research and Standardization." The mornings of September 2 and 3 will be devoted to the reading and discussion of no fewer than 16 papers dealing with many differing aspects of metallurgical work. In the afternoons visits will be paid to works in the Glasgow district and in the evening of September 2, a reception is to be given by the Lord Provost and Corporation of Glasgow. The concluding day of the meeting, September 4, is set apart for a visit to the Trossachs and Loch Lomond.

Technical Discussion.

The following communications are expected to be submitted:

1. Anderson, Robert J., B.Sc., (Boston, Mass., U.S.A.) and Everett G. Fahlman, B.S. (Cleveland, O., U.S.A.), "The Effect of Low-Temperature Heating on the Release of Internal Stress in Brass Tubes."
2. Andrew, Professor J. H., D.Sc., and Robert Hay, B.Sc., A.I.C. (Glasgow). "Colloidal Separations in Alloys." (Note.)
3. Brown, John S. (Greenock). "The Influence of the Time Factor on Tensile Tests Conducted at Elevated Temperatures."
4. Callendar, L. H., B.Sc., A.I.C., A.R.C.S. (London). "Passification and Scale Resistance in Relation to the Corrosion of Aluminum Alloys."
5. Deeley, R. B., A.R.S.M., B.Sc. (London). "Zinc-Cadmium Alloys. A Note on their Shear Strengths as Solders." (Note.)
6. Donaldson, J. W. (Greenock). "Thermal Conductivities of Industrial Non-Ferrous Alloys."
7. Ellis, Professor O. W., M.Sc. (Toronto, Ont.,

Canada). "The Influence of Pouring Temperature and Mould Temperature on the Properties of a Lead-Base Anti-Friction Alloy."

8. Gayler, Marie L. V., D.Sc. (Teddington). "On the Constitution of Zinc-Copper Alloys containing 45 to 65 per cent of Copper."
9. Greaves, R. H., D.Sc. and J. A. Jones (Woolwich). "The Effect of Temperature on the Behaviour of Metals and Alloys in the Notched-Bar Impact Test."
10. Hanson, D., D.Sc. and Marie L. V. Gayler, D.Sc. (Teddington). "On the Constitution of Alloys of Aluminum, Copper and Zinc."
11. Haughton, J. L., D.Sc. (Teddington) and W. T. Griffiths, M.Sc., F.I.C. (Woolwich). "The Beta Transformations in Copper-Zinc Alloys."
12. Hyman, Harry, Ph.D. (Glasgow). "The Properties of some Aluminum Alloys."
13. Ingall, Douglas H., M.Sc. (Wednesbury). "The High Temperature-Tensile Curve. (a) Effect of Rate of Heating. (b) Tensile Curves of Some Brasses."
14. Jenkins, C. H. M., B.Sc., A.R.S.M. (Teddington). "The Physical Properties of the Copper-Cadmium Alloys Rich in Cadmium."
15. Phillips, George Brinton, A.B. (Philadelphia, Pa., U.S.A.). "The Primitive Copper Industry of America."
16. Stockdale, D., B.A. (Warrington). "The Alpha-Phase Boundary in the Copper-Tin System."

Members and student members desirous of receiving advance copies of any of the above should make early application on the accompanying reply form. Those who attend the meeting should bring their advance copies with them, as it may not be possible to supply additional copies at the meeting.

Members and student members are earnestly requested to ask only for communications in which they are particularly interested. Copies can be supplied a week before the meeting.

Foreign Survey

By Albert P. Sachs*

In view of the all too general criticism of the steel industries of the world, it is interesting to note that although output was far below capacity in all countries, nevertheless the productive capacity is below that which it should have reached by normal growth from 1913 to 1925. In an article in the "Financial Times" Sir William J. Larke K.B.E. reviews the progress towards recovery that has been made in the iron and steel industry for 1924 and considers the prospects for 1925. The approximate annual capacities for pig-iron and steel production of the various countries were given as follows:

Country	Tons Pig-Iron	Tons Steel
U. S. A.	52,700,000	59,000,000
Germany	12,000,000	14,000,000
Great Britain	12,000,000	12,000,000
France (and the Saar)	11,000,000	10,000,000
Belgium	3,250,000	3,250,000
Luxemburg	2,800,000	2,000,000
All others	5,000,000	5,000,000
Total	98,750,000	105,250,000

Thus the United States are seen to have about 55 per cent of the world's total productive capacity. The world output of pig-iron and steel was higher in 1913 than in 1923 or 1924 and under normal conditions of growth should have reached a total of 127,000,000 tons as compared to an actual output of 62,000,000 tons.

An article in Stahl und Eisen on pig-iron prices in Germany and other countries since 1900 contains a wealth of statistical data in the form of tables and curves. Germany currency depreciation for a time made German pig-iron the lowest-priced in the world, although it is entitled to a premium as compared to British and Continental irons on the basis of analysis. The reasons for differences in production costs in various countries are indicated. The writer concludes that the French-Lorraine blast furnaces operate at the lowest cost.

Refractories are always interesting and important. Dr. Steger of the Materials Committee of the Association of German Blast Furnace Operators in a report on "The Resistance of Refractories to Temperature Changes" reached the following important conclusions:

1. The resistance of refractories to temperature change is a property which depends not only on the composition of the raw materials used but also on the fine structure and the form of the finished shapes.

2. For testing this resistance the following methods were adopted:

   (a) Heating a test piece to a given temperature, sudden chilling and subsequent determination of loss in weight or of strength.

   (b) Determination of a coefficient of thermal resistance from tensile strength, coefficient of thermal expansion, modulus of elasticity, thermal conductivity, specific weight and specific heat from the formula of Winckelmann and Schott (applicable only to sintered products),

   (c) Determinations of thermal expansion coefficients at 15-300, 300-500, 500-600, 600-750 (deg. C.) to discover the volume changes in firebrick and silica brick due to allotropic changes in the crystal form of silica.

3. On the basis of the chilling tests the following relative values for the sensitivness of refractory products to temperature changes, taking magnesia bricks = 100, were determined:

Carborundum bricks (clay binder)	2
Bauxite bricks	13
Zirconia bricks	16
Firebrick bricks	3-30
Chromite bricks	42
Silica bricks	75
Magnesia bricks	100

4. In the case of firebrick it is shown by measuring the coefficients of thermal expansion that the great differences (3-30) shown above, which are well known in practice, are due to the amount, grain size and crystal form of the silica modifications present.

5. In the case of silica bricks the determination of coefficients of thermal expansion shows the known sensitivity of highly burned silica bricks to temperature changes is due to the alpha-beta-cristobalite inversion occurring at 230 deg. C.

Cold drawing is the subject of several studies. One is by M. Delbart in the Comptes Rendus de l'Academie des Sciences and deals with the changes in physical properties. A more extensive contribution is by Friedrich Körber of Düsseldorf in Stahl und

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*Technical Director, Universal Trade Press Syndicate.

Eisen. It is called "Deformation and Recrystallization" and is a theoretical consideration of the cold working of metals. He considers the changes in the properties of metals caused by cold working and subsequent annealing and their significance in practical work. He follows up the changes in the fine structure and considers the mechanism of cold working. A crystallographic consideration is undertaken and the various theories of cold working and cold hardening are discussed followed by an investigation of the cold deformation structures of metals as revealed by the X-ray. He then gives his theory of recrystallization, of grain growth and its significance for the strength properties. He also determines the limits of cold and hot working. The article is amply illustrated and is commended to all who are interested in the underlying principles of cold working.

Georges Batta, Chief of Laboratory of the Royal Belgian Gun Factory contributes "Certain Remarks on the Subject of Analyses of Pig Iron" to Chimie et Industrie. He pays especial attention to the evolution of the manufacture of steel-like cast iron and studies the variations in composition of one lot or pour, and the causes for them.

E. Piwowarsky of Aachn writes on the Improvement of Cast Iron by the Addition of Alloys. He studies the influence of aluminum, titanium, nickel, chromium, nickel and chromium, vanadium, tungsten, molybdenum and vanadium, tungsten and molybdenum on the properties of gray cast iron together with a critical discussion of the results. The results are very far-reaching but because of their tabular nature are not easy to quote from. A sample in one case, of Swedish cast iron was used with the following additions:

A — 175 per cent silicon.

B — as A, and 0.5 per cent manganese, 0.1 per cent phosphorus and 0.15 pr cent sulphur.

C — as B, and 0.2 per cent nickel and 0.5 per cent chromium.

The test results were as follows:

		Total Carbon	Flexional Resistance Kg/mm^2	Deviation of bar (both ends supported) mm.	Tensile Strength Kg/mm^2
A	—	3.78%	20.5	6.00	10.0
B	—	3.74%	30.6	8.00	15.5
C	—	3.81%	40.2	9.00	23.6

Foreign books relating to our field continue to appear in large number. We have selected two for notice in this column. M. V. Schwartz, professor at the Technical High School at Munich is author of a popular treatise on the Metallurgy of Iron in the famous Göschen Library Series. Volume 1, on Pig Iron, is 128 pages, contains 34 figures and a table, is of pocket size and costs only 1.25 gold marks (30 cents). It is excellently written and is of service to the layman as well as to those in the industry.

Prof. P. Schimpke and Chief Engineer Hans A. Horn are authors of a "Practical Handbook of Welding Technology." Volume 1 covering "Autogenous Welding and Cutting" has VI, 134 pages, 111 illustrations and three tables and costs 6.90 gold marks (about $1.65). This first volume of a complete treatise is at its best in the second section of 60 pages dealing with welding gases, apparatus and equipment. It refers to all kinds of ferrous and non-ferrous metals and to soldering.

Franco-German Iron Trade Agreement

The agreement recently concluded between France and Germany is apparently meeting with difficulties at the very commencement, if the reports just at hand from Berlin are correct. The report refers to the disputed question of the import quotas to be allowed in the future. The reports, however, are so far neither admitted nor denied. It is set forth that the German industrialists have agreed to allow imports of 1.7 million tons a year at half the normal duty, of which 800,000 tons may come from France, 600,000 tons from the Saar, and 300,000 tons from Luxemburg. Delivery is to be between syndicate and syndicate, so that the German Iron and Steel Works Union will continue to have a firm control of the German market, and so be able to fight effectively against imports from other quarters. No statement has been made as to the consideration to be given in return for this by the French, but mention is made of a facilitation of the import of machinery from Germany.

In connection with the agreement it may be mentioned that the German iron consumers, and especially the metal-ware industry, are protesting with growing energy against the tariff proposals of the heavy industry. A resolution passed by the metal ware industry demands among other things, a substantial reduction in all duties on raw material and semi-products, and a withdrawal of the official measures designed to promote cartellization. It remains to be seen whether the dexterously constructed Federation of German Industries will not suffer under the conflict of interests. However, as the finished goods industry has in most cases its own proposals to make in regard to tariffs, it is probable that the German industrialists will, after all, come to an agreement enabling them to co-operate in obtaining for one another the desired advantages. The ultimate result would be a slight improvement in Germany's ability to compete in the world markets with her semi-products, but a substantial loss for her in regard to chances of competition with her finished manufacturers.

Industrial Health Important

(Continued from page 363)

paired heart or a kidney disturbance that had never been suspected. Unless he is in such a dangerous condition that an employer would not be justified in accepting him, he can be placed in a job where the physical demands would not make too severe a strain upon him. Organizations requiring physical examinations also are likely to have some degree of medical service available for their employes, so the person learning of an impairment may be directed in correcting it.

"With the health supervision of large forces has developed group insurance of one form or another. Such organizations are usually ordered so that there is a minimum turn-over of labor and a man has the highest possible degree of security. When he is accepted as an employe he automatically, after a short period, becomes eligible for these benefits.

"Leading industrial and business organizations have adopted measures for the protection of their forces' health and security. In my opinion it is these group efforts, scattered throughout the country, that are now making themselves felt nationally in the way of a new health level with a general reduction in mortality that shows itself both in insurance experience and in the general population."

The Design and Inspection of Gear Teeth For Wear

Gears Have Become a Most Important Element in Modern Production Methods—The Formulae Here Presented Should Be of Timely Value

By **P. M. GALLO***

PART I

THE action of two meshing gear teeth as they pass through the arc of action is partly rolling and partly sliding, pure rolling occurring through a small arc as the point of contact passes through the pitch line, the rest being simultaneous rolling and sliding. The greatest rate of sliding and greatest wear occur at the beginning of the arc of action. As the gears approach equality in diameter and as the diameters increase, the ratio of rolling to sliding increases. Cycloidal teeth have a much greater ratio of rolling to sliding than involuate teeth. The ratio of rolling to sliding decreases as the angle of action increases.

The primary action of meshing gear teeth is one curved surface rolling over another curved surface. Due to the elasticity of the material there exists an area of contact which is a function of the tooth pressure, and the radius of curvature of the teeth faces or profiles. The unit bearing pressure on this contact area will be a measure of wear due to the sliding action.

The area of contact can be calculated approximately by the formulas for the deformation of rollers under load. The conditions of loading will not be exactly the same hence the result will be approximate, but the error will be small and the percentage error will be the same for all calculations hence the ratios for comparison will not be effected.

The deformation of rollers under load has two limiting conditions as follows: (Roller rolling on a flat plate.)

Condition I — The roller takes all the deformation.

Condition II — The roller and plate deform equally. This was proven experimentally to be true when roller and plate have the same elasticity or are made from the same material.

Since materials non-elastic are unknown, case I is purely hypothetical, but is very convenient in applying its formula to gear teeth.

Condition I is depicted in sketch Fig. 1, full lines. W = load, D = diameter of roller A, P = plate and "a" shows amount of flattening.

If another roller B, of the same dia. "D" as roller "A", be placed on the opposite side of plate P, and carrying a load W as shown, the line through the centers of A and B being normal to P, and both rollers being of the same material, then the flattening chord "b" of roller B must be equal to the flattening chord "a" of roller A. As the thicknss of the plate does not effect this condition, it can be regarded as infinitesimally thick when "b" being equal to "a" will coincide with same.

Therefore two rollers of equal diameter and of the same material, tangent to each other will have the same deformation or contact area as either roller rolling on a flat plate under the same contact pressure, the roller considered taking all the deformation, or the previous stated case I. This applies to a pair of gears of equal diameter and of the same material; for the tooth profiles, hence the rolling arcs will be the same. (For gear of 37 teeth and over, involute system.)

Both rollers being of the same material, if "A" is considered of finite diameter, "B" be increased to an infinitely large diameter, "B" would approach a flat surface and condition II would be attained, a roller rolling on a flat plate, under load, roller and plate deforming equally. This applies to a pinion or gear and a rack, or two gears of equal diameter having less than 37 teeth each, involute system.

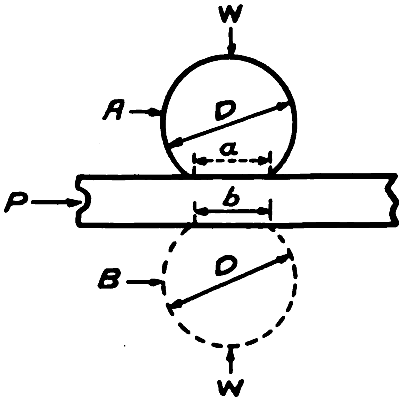

FIG. 1—*Sketch illustrating the condition where roller takes all deformation.*

All involute gear teeth deformations or contact areas will lie between these two limiting conditions depending on their relative diameters.

For the derivation of the formulas for the stress and deformation of rollers under load refer to Merriman's Mechanics of Material.

Roller Formulas—Notation Used.

Let S = maximum compressive unit stress in roller, lbs. per sq. in., at contact.

Let W = load carried by roller, lbs.

Let E = modulus of elasticity of roller material.

Let a = area of contact or bearing area, sq. inches.

Let l = length of roller, inches.

Let d = diameter of roller, inches.

Let K = unit bearing pressure at roller contact.

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*Pittsburgh, Pa.

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lbs. per sq. in. $= \dfrac{W}{a}$

Case I — Roller takes deformation, plate considered inelastic.

$$S = \sqrt[3]{\frac{9W^2E}{8l^2d^2}} \text{ ---- Eq ①,} \qquad W = \frac{2}{3}\, lds\sqrt{\frac{2S}{E}} \text{ -- — Eq ②,}$$

$$a = 2\,ld\sqrt{\frac{S}{2E}} = (ld)^{\frac{2}{3}}\left(\frac{3W}{E}\right)^{\frac{1}{3}} \text{ ----- Eq ③ } = ld\sqrt{\frac{2S}{E}}$$

$$\text{Let } l=1,\ d=1, \text{ then } W = \frac{2S}{3}\left(\frac{2S}{E}\right)^{\frac{1}{2}} = \left(\frac{8S^3}{9E}\right)^{\frac{1}{2}}, \quad a = \left(\frac{2S}{E}\right)^{\frac{1}{2}}$$

$$\frac{W}{a} = K = \frac{\left(\frac{8S^3}{9E}\right)^{\frac{1}{2}}}{\left(\frac{2S}{E}\right)^{\frac{1}{2}}} = \frac{2S}{3} \text{ ---—— Eq ④}$$

$$S = \frac{3K}{2} \text{ ——— Eq ⑤}$$

This value of K is independent of l and d as long as the load is such that S remains the same.

Case II — Roller and plate deforming equally.

$$a = \sqrt[3]{2}\, ld\sqrt{\frac{2S}{E}} \text{ .... Eq ⑧a}$$

$$S = \left(\frac{9W^2E}{16l^2d^2}\right)^{\frac{1}{3}} \text{ ..... Eq ⑥,} \quad W = \frac{4}{3}\, lds\left(\frac{S}{E}\right)^{\frac{1}{2}} \text{ --- Eq ⑦,} \quad a = (ld)^{\frac{2}{3}}\left(\frac{6W}{E}\right)^{\frac{1}{3}} \text{ -- Eq ⑧}$$

$$\text{again let } l=1,\ d=1, \text{ then } K = \frac{W}{a} = \frac{\left(\frac{16S^3}{9E}\right)^{\frac{1}{2}}}{\left(\frac{6W}{E}\right)^{\frac{1}{3}}} = \frac{2S}{3} \text{ same as Eq ⑤}$$

This value of K is also independent of d and l same as before, as long as "S" remains the same.

Since the value of "K" is the same in both cases for the same value of S the loads will be relatively $\dfrac{W_2}{W_1}$ where W_1 and W_2 are the loads in cases I and II, "S" remaining the same.

Then

$$\frac{W_2}{W_1} = \frac{\frac{4}{3}\, lds\left(\frac{S}{E}\right)^{\frac{1}{2}}}{\frac{2}{3}\, lds\left(\frac{2S}{E}\right)^{\frac{1}{2}}} = 2\,\frac{S^{\frac{1}{2}}}{2^{\frac{1}{2}}S^{\frac{1}{2}}} = \frac{2}{\sqrt{2}} = \sqrt{2} = 1.414, \quad W_2 = 1.414\, W_1$$

Application of Above Roller Formulas To Gear Teeth—Notation Used.

Let F = face of gear and pinion, inches.

Let r = smaller radius of tangent face arcs of tooth profile inches.

Let R = larger radius of tangent face arcs of tooth profile inches.

Let p = circular pitch, inches.

Let q = load factor, depending on ratio of tangent face arcs radii.

Let W = tooth load, pounds.

Let E = modulus of elasticity of gear material or lower value.

Let e = modulus of elasticity of pinion material or higher value.

Let S = unit compressive fibre stress at point of contact, lbs. per sq. in.

Let K = allowable unit bearing pressure, lbs. per sq. in.

Let n = number of teeth in pinion.

Let N = number of teeth in gear.

Let r.p.m. = revolutions per minute of pinion.

Let R.P.M. = revolutions per minute of gear.

Let $U = \dfrac{\text{r.p.m.}}{\text{R.P.M.}} = \dfrac{N}{n}$

First assuming both meshing gears of equal diameter, and of the same material, and E = e.

Replacing symbols in Eq. (2) by their equal in gear notation l = F, d = 2rp, W remains unchanged, only it represents the tooth load.

Then Eq. (2) becomes:

$$W = \frac{2}{3}\, F\, 2rpS\sqrt{\frac{2S}{E}} = \frac{4}{3}pFrS\sqrt{\frac{2S}{E}} \text{ ------ Eq ⑨}$$

This value corresponds to the roller Case I.

Since the other limiting case is a pinion and rack which corresponds to roller, Case II, in which the above value of W would be multiplied by the factor 1.414 as previously shown.

To derive a factor expression incorporating all intermediate values it will be necessary to revert to the roller and plate.

Let D = total deformation of roller and plate = D1 and D2.

Let D1 = deformation of plate.

Let Z = represent the right hand member of Eq. (9).

Let q = the ratio $\dfrac{D1}{D}$

Let D2 = deformation of roller.

$$\text{Then Eq ⑨ can be written } W = \left(\frac{\frac{\Delta}{2} + \Delta_1}{\frac{\Delta}{2}}\right)^{\frac{1}{2}} Z \text{ ----- Eq ⑩}$$

This coefficient of Z satisfies both limiting conditions as is shown by following inspection:

When the roller and plate deform equally D1 $= \dfrac{D}{2}$, substituting this value in Eq. (10):

$$W = \left(\frac{\frac{\Delta}{2} + \frac{\Delta}{2}}{\frac{\Delta}{2}}\right)^{\frac{1}{2}} Z = \sqrt{2}\, Z = 1.414\, Z$$

When the roller takes all deformation and the plate none D1 = 0. Again substituting in Eq. (10):

$$W = \left(\frac{\frac{\Delta}{2} + 0}{\frac{\Delta}{2}}\right)^{\frac{1}{2}} Z = \sqrt{1}\, Z = Z$$

All intermediate values follow the same law.

To reduce the coefficient of Z to a simpler form, substitute the equal of D1, or qD, then

$$W = \frac{\frac{\Delta}{2} + q\Delta}{\frac{\Delta}{2}}^{\frac{1}{2}} Z = \sqrt{1+2q}\, Z \text{ ------ Eq ⑪}$$

(To be continued.)

The Fails Steel Tube & Manufacturing Company, Newton Falls, Ohio, has completed arrangements for the operation of a local plant for the manufacture of welded steel tubing in various diameters and lengths. The new works have been provided with modern equipment and will be developed to maximum capacity. The company was organized recently by R. A. Kenworthy, formerly secretary of the Newton Steel Company, Youngstown, Ohio, who will be president.

Iron and Steel Exposition

Twentieth Annual Convention of the Association of Iron and Steel Electrical Engineers Will Be Held in Philadelphia

EACH year finds the Electrical Engineers doing bigger things. In 1923 Buffalo awoke to find a new electrified foundry producing commercial steel castings in the Exposition Building, a complete foundry built in five days. In 1924, the Duquesne Garden in Pittsburgh was necessary to take care of the crowds which came and saw the world's progress in electrical development.

This year it is Philadelphia, where during the entire week, September 14-19, at the Commercial Museum, the thousands of visitors, among whom will be numbered the most prominent electrical, combustion and safety engineers, will witness a complete electric-heated soaking-pit in practical operation. This in itself is worth a trip to Philadelphia.

Safety will be strongly emphasized at this convention, under the inspiration of Judge Burnett of the Carnegie Steel Company. The steel industry owes much to Mr. Burnett, whose untiring zeal has made the Safety Crusade a reality. As general chairman of this division, there is always a guarantee of the unlimited enthusiasm which the cause deserves and demands.

The complete program follows:

Monday, September 14, 1925—12:30 noon, Benjamin Franklin Hotel, Crystal Ball Room.

Safety Division, 1:30 P. M. L. H. Burnett, general chairman; C. L. Baker, vice chairman. The first session of the convention will be devoted to the Safety Division. Starting with a luncheon at 12:30, the program will be continued until completed. Introduction, A. C. Cummins, president A. I. & S. E. E. Remarks, L. H. Burnett, assistant to president, Carnegie Steel Company, Pittsburgh, Pa. Remarks, Henry A. Renninger, assistant to president, Portland Cement Company, Allentown, Pa. "How the Electrical Engineer and the Safety Engineer Can Be Made Mutually Helpful," by John A. Oarte, chief of Safety Bureau, Carnegie Steel Company, Pittsburgh, Pa.

Tuesday, September 15, 9:30 A. M.—Philadelphia Commercial Museum. D. M. Petty, general chairman; F. W. Cramer, secretary. "The Selection and Maintenance of Oil Circuit Breakers," by George A. Burnham, Condit Electrical Mfg. Company, Boston, Mass.

11:00 A. M.—"The Selection and Maintenance of Oil Circuit Breakers," by M. J. Wohlgemuth, switchboard enigneer, Westinghouse Electric & Mfg. Company, and E. K. Reed, circuit breaker engineer, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

12:00 Noon—Lunch. Cafeteria, Philadelphia Commercial Museum.

1:00 P. M.—Discussion of paper, "The Selection and Maintenance of Oil Circuit Breakers."

Wednesday, September 16—Philadelphia Commercial Museum, C. S. Proudfoot, chairman.

9:30 A. M.—"Direct Current Armature Windings for Multipolar Generators and Motors"; "Frog Leg Windings," by W. A. Powell and G. M. Albrecht, Engineering Department, Allis-Chalmers Mfg. Company, Milwaukee, Wis.

Thursday, September 17, 9:30 A. M.—Philadelphia Commercial Museum, George H. Schaeffer, chairman. "Electric Heat Treating Furnace Applications," by E. A. Hurme, manager Steel Mill Division, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa. "Electric Melting Furnaces," by J. A. Seede, industrial engineer, General Electric Company, Schenectady, N. Y. Report of Electrically Heated Soaking Pit in Operation at the Donner Steel Company.

Friday, September 18, 9:30 A. M.—Philadelphia Commercial Museum Lecture Hall, R. S. Shoemaker, chairman. "Auxiliaries and Auxiliary Drives for Steam Electric Generating Stations," by A. L. Penniman, Jr., and F. W. Quarles, Consolidated Gas, Electric Light & Power Company of Baltimore, Baltimore, Md.

11:00 A. M.—"Extending the Heat Cycle in Boiler Operation by the Use of Preheated Air for Combustion," by J. G. Worker, vice president, American Engineering Company, Philadelphia, Pa.

GENERAL ARRANGEMENTS COMMITTEE

TWENTIETH ANNUAL CONVENTION

GEORGE H. SCHAEFFER, General Chairman
HEADQUARTERS — THE FOYER, MEZZANINE FLOOR,
BENJAMIN FRANKLIN HOTEL

Registration and Bureau of Information Headquarters

F. H. Kitteridge, General Chairman
Headquarters — The Foyer

RECEPTION COMMITTEE
J. R. Penman, Chairman
Headquarters — The Foyer

ENTERTAINMENT COMMITTEE
Monday Evening — Informal Dance
P. T. Vanderwaart, Chairman
Headquarters — The Foyer

Thursday Evening — Dinner Dance
F. O. Schnure, Chairman
Headquarters — The Foyer

Iron and Steel Exposition Committee Philadelphia Commercial Museum

Headquarters — Main Canopy Booth
Center of Hall — John R. Doyle in charge.

NATIONAL EXECUTIVE COMMITTEE
Headquarters — The Foyer, Mezzanine Floor

INVITATION COMMITTEE
W. S. Hall, Chairman
Headquarters — The Foyer

PHILADELPHIA EXECUTIVE COMMITTEE
L. O. Morrow, Secretary
Headquarters — The Foyer

Executive Officers, Philadelphia District Section, Association of Iron and Steel Electrical Engineers, Who Will Look After The Convenience and Comfort of Their Guests At Philadelphia.

G. J. WALZ
Asst. Elec. Supt. Steelton Plant, Bethlehem Steel Company, Steelton, Pa.
Executive Committeeman, Philadelphia Dist., A. I. & S. E. E.

FRED O. SCHNURE
Elec. Engr. Bethlehem Steel Company, Sparrows Point, Md.
Executive Committeeman, Philadelphia Dist., A. I. & S. E. E.

H. SEARLLS BOONE
Shoemaker Bridge Company, Pottstown, Pa.
Chairman Philadelphia Dist. A. I. & S. E. E.

LYNN O. MORROW, Secretary
Philadelphia District Section, A. I. & S. E. E.

GEORGE PFEFFER,
Florence Pipe Foundry & Machine Company, Florence, N. J.
Executive Committeeman, Philadelphia Dist., A. I. & S. E. E.

LIST OF EXHIBITORS

AT

Iron and Steel Exposition

Name	*Booth No.*
Allen Bradley Company	48
American Pressed Steel Company	63
Allis Chalmers Mfg. Company	83-94
Alliance Machine Company	95
Appleton Electric Company	195-198
American Electric Fusion Corporation	215
Andresen Company, The	82
Baker R & L Company	20-37
Bartlett Hayward Company	27-30
Benjamin Electric Mfg. Company	39
Bussmann Mfg. Company	107
Celite Products Company	64
Cutler Hammer Mfg. Company	26-31
Calebaugh Self Lubricating Carbon Company	41
Cutter Electric & Mfg. Company, The	77-100-101
Craven Electric Sales Company	89
Crouse Hinds Company	104-105
Chicago Fuse Mfg. Company	130
Corliss Carbon Company	131
Condit Electric Mfg. Company	178-179-166-167
Crocker Wheeler Company	50
M. H. Detrick Company	71
Dolph Company, John C.	222
Economy Electric Products Company	213
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Electric Service Supplies Company	113-136-137-160
Electric Controller & Mfg. Company	114-135
Economy Fuse & Mfg. Company	154
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Fuels & Furnaces	208
Fuller Lehigh Company	19-38
General Furnace Company	129-144
General Electric Company	145-152-153-168-169-176-177-192-193-200-201
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Marlin Rockwell Company	93
McGraw-Hill Company	199
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How to Reach Museum From Benjamin Franklin Hotel

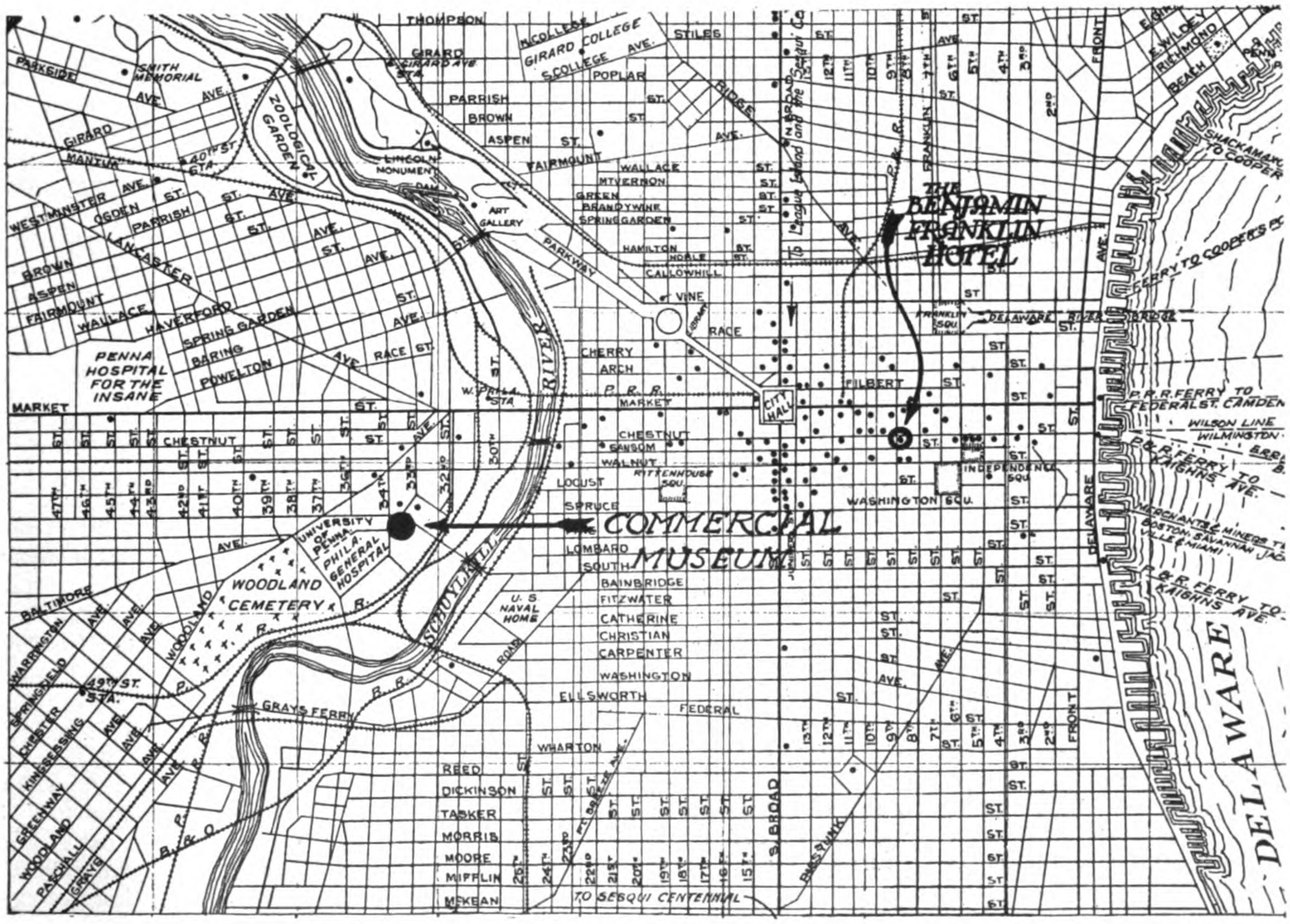
To reach Museum take any car southbound on Eighth or Tenth Street and transfer at South Street to Route 40 westbound.

An alternate route is by way of Route 13 on Walnut Street, one block from hotel, to Thirty-fourth Street. Museum is five minutes' walk from this point.

You may also board westbound subway trains at Eighth Street Station of the Market Street Subway-Elevated, changing at Thirteenth Street to subway-surface routes 11, 34 or 37. These three lines pass the intersection at Woodland Avenue and Spruce Streets, about five minutes' walk from the Museum.

The Walnut Street motor bus line Route D runs between Broad and Sansom Streets and Sixty-third and Walnut, and one stopping at Broad Street hotels should find this route quite convenient.

Benjamin Franklin Hotel

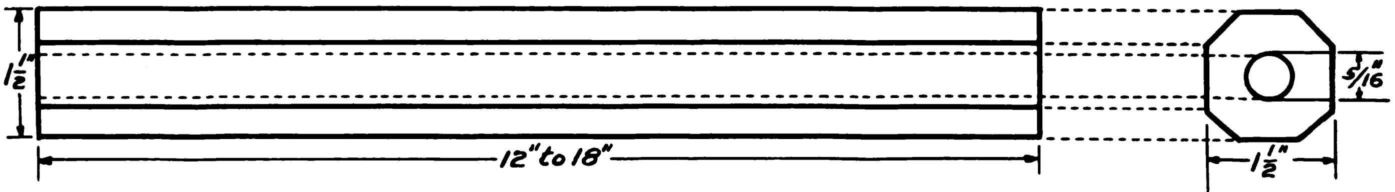


Improved Oxygen Lance For Open Hearth

By **T. C. FETHERSTON***

USE of the oxygen lance for opening tap holes in open hearth furnaces, once considered valuable as an emergency expedient only, is becoming more and more a routine of efficient operation. Many plants have entirely discarded the bar and sledge in favor of the more positive action of the lance, and as experience with this method grows, open-hearth superintendents are finding that the oxygen lance is not only quicker and more dependable, but is cheaper as to materials used and is also preferred by the workmen.

As detailed descriptions of furnace tapping by the oxygen lance have been published frequently, most steel men undoubtedly understand the principles involved. The large oxygen producers and oxy-acetylene apparatus manufacturers will gladly aid others who have had no experience with this method or who desire to test its merits under actual operating conditions.



WOODEN TIP FOR OXYGEN LANCE

One of the features of this method of tapping is the fact that the steel or wrought iron pipe which forms the lance is consumed very rapidly at the hot end. When refractories or pockets of slag are encountered, the heat from the burning pipe melts through the obstruction. This use is justifiable, but most of the pipe burns merely because it gets red hot and is bathed in oxygen. The pipe is generally bent or screwed into a piece of bent pipe forming a handle, so the workmen can stand off at the side of the tap hole. While the pipe is not very expensive, the time required for its replacement in the lance is sometimes very valuable. Therefore a method to restrict the consumption of pipe is desirable if the same results can still be obtained.

A study of operations from this viewpoint at one of the great steel plants in the Pittsburgh district has developed the following simple expedient: Pieces of 1½-in. scrap hardwood lumber are cut 12 to 18 in. long. These are used in whatever form is convenient, round, square or octagon, the last being most general. They are drilled lengthwise to fit snugly over the pipe used in the lance.

These wooden tips are fitted over the end of the lance, the pipe extending 4 to 6 in. into the tip. There is no change in the method of operating the lance. It is sometimes necessary to use a short iron bar, white hot, to furnish fuel for combustion if the lance encounters an unusual amount of refractory material, such as clay from the plug, bits of furnace lining or heavy slag.

Instead of being entirely consumed, as might be expected, the wooden lance tip burns away until it has become smoothed down to a tapered point. When this condition has been reached the charred section seems to protect the tip from further rapid combustion.

Sometimes a single wooden tip can be used for several tappings, depending, of course, upon the length of time required to open the tap holes. In any event, these wooden tips make it possible to use a single length of pipe a number of times, provided tips are not allowed to burn away to the point where the end of the pipe is consumed. In opening steel ladles the wooden tip is especially useful. The chill to be penetrated is clean metal, hot enough to burn in the oxygen without any help from the lance pipe. By replacing the tip from time to time, one piece of steel pipe will last indefinitely on the teeming platform.

Another excellent application is in opening the notch hole in the bottom of the soaking pits, to drain off an accumulation of scale. Ordinarily it is necessary to cool a pit for several hours down to a temperature where the lance pipe will not quickly get red hot throughout its length and burn too rapidly. If it is undesirable to keep the pit out of service that long, the lance pipe can be covered from end to end with these wooden sleeves, which then act as an effective insulation against the heat.

British Iron and Steel Institute

In accordance with preivous announcements, the Autumn Meeting of the Iron and Steel Institute will be held at the University, Edmund Street, Birmingham, England, on Wednesday, Thursday and Friday, September 9th, 10th and 11th, 1925. The following is the list of papers which it is expected will be submitted to the meeting:

J. H. Andrew and R. Higgins, "The Dilatation of Cast Irons During Repeated Heating and Cooling."

M. L. Becker, "Equilibrium at High Temperatures in the Iron-Carbon-Silicon System."

D. F. Campbell, "High Frequency Induction Furnaces."

E. D. Campbell and J. F. Ross, "The Chromium-Iron Equilibrium in Carbides Recovered from Annealed 2.23 per cent Chrome Steels."

A. L. Curtis, "Steel Moulding Sands and Their Behavior under High Temperatures."

(Continued on page 378)

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*New York City.

The POWER PLANT

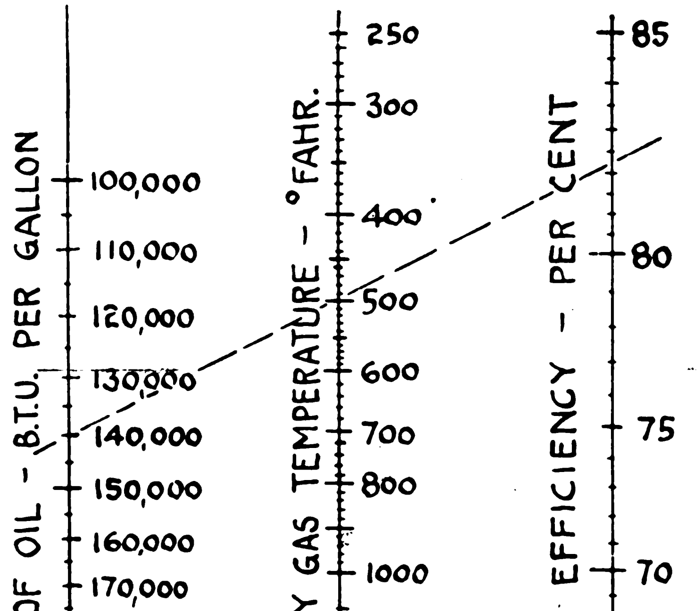
Efficiency of Oil-Fired Boilers

A Convenient Operating Device Which Can Be Revised for Any Fuel

By W. F. SCHAPHORST, M.E.*

THIS handy little chart will quickly give the approximate efficiency of any boiler that is oil-fired, knowing the heat value of the oil and the temperature of the chimney gases.

Simply run a straight line through the heat value of the oil in Btu. per gallon in column A, and through the chimney gas temperature in deg. F., column B, and the intersection of the straight line in column C gives the approximate boiler efficiency in per cent.



For example, the dotted line running across this chart shows that if the heat value of oil is 140,000 Btu. per gallon and if the chimney gas temperature is 500 deg. F., the boiler efficiency should be about 82.2 per cent.

This chart is based upon the following simple rule which was developed by the writer. It is not claimed to be "absolutely accurate" but for general use it will be found to give surprisingly close results. The rule is:

"Multiply the chimney gas temperature in deg. F. by 5,000 and divide by the heat value of oil in Btu. per gallon. Subtract the result from 100. The remainder is the approximate boiler efficiency in per cent. Thus applying this rule to the above example where the temperature is 500 deg. F. and the heat value of the oil 140,000 Btu. per gallon, we get 500 × 5,000 = 2,500,000. Dividing by 140,000 we get 17.8. Subtracting from 100 the result is 82.2 per cent as shown by the chart.

It is obvious that if combustion is complete and if we have a low chimney gas temperature the boiler efficiency is bound to be high because the heat certainly has been absorbed by the boiler. The heat must go somewhere and the higher the chimney gas temperature the lower the boiler efficiency, as indicated by this chart.

A careful study of the chart shows how important it is to maintain a low chimney gas temperature and avoid high temperatures. It also shows that oils of high value are liable to give higher boiler efficiencies than are oils of low heat value, the chimney gas temperature being the same in all cases.

A number of years ago the writer developed a chart of this type based on coal as the fuel and found it gave very good results and for that reason he is now presenting this chart for the benefit of those who are burning oil under their boilers.

New York Power Show

The Fourth National Exposition of Power and Mechanical Engineering will be held in the Grand Central Palace, New York, from November 30 through December 5, 1925.

The Power Show, as this exhibition is styled, is an important clearing house of information for the executives and engineers of all industries. In this it is different from the exhibitions devoted to the equipment of a single industry as power is a fundamental factor in every industry and a showing of the machines and apparatus required for its economical generation

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*45 Academy St., Newark, N. J.

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and use gives an opportunity to every industrial executive to discover some means of cutting his promotion costs.

At the coming show a series of exhibits of heating and ventilating machinery will form an important addition to the lines usually represented. This broadening of the scope of the show is an acknowledgment of the increased importance that manufacturers now attach to the need for modern methods of heating ventilation in the factory. The heating and ventilating problem is closely allied to the power problem of an industry and the advances in one art are generally applicable to the other. This innovation at the coming show will, therefore, increase its value to the visitors who will find much of real worth in the exhibits of all phases of the heating and ventilating art.

The list of exhibitors to whom space has already been assigned indicates the thoroughness with which the field of power generation and use will be covered. From the handling of the coal to the boiler to use of power at the shaft, from the hand shovel to the elaborate coal handling and storing equipment, and from the belt fastener to the enormous pressure mover, every class of device, machine, apparatus or process that enters into power generation and use will be represented in the exhibition. Combustion equipment, valves and fittings for high temperature service, measuring and recording instruments, non-ferrous metals and prime movers will have their usual prominent parts in the show.

The tremendous growth of the Power Show during the three short years of its existence is an excellent indication of the appreciation that American industry has of its dependence upon the increasing use of cheaper power for the decreased costs with which it must be armed to meet world competition. From 48,000, the first year's attendance, the number of visitors last December increased to 79,000. In 1922, the first year of the show, there were 100 exhibits on one floor of the Palace, while the third show housed 360 exhibits and nearly filled three floors. The fact that 400 contracts have been signed for space at the coming exhibition is ample evidence that the manufacturers of power generating and using equipment fully appreciate the value of the show as a clearing house for the latest news of modern developments in this highly important field.

As usual, the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers will be held during the week of the show and their programs have been planned to allow opportunity for a thorough inspection of the exhibits.

The managers of the show are Fred W. Payne and Charles F. Roth with offices in the Grand Central Palace.

October 8, 1925

Annual Meeting of the Eastern States Blast Furnace and Coke Oven Association to Be Held in Buffalo, N. Y.

An Interesting New Scherbius Drive

By H. C. UHL*

THE Trumbull Steel Company of Warren, Ohio, have just purchased a new type of double range Scherbius drive which is, we believe, the first of this type ever built.

The main induction motor is rated type MT-20 pole, 5000/4000/3000 hp., 450/360/270 rpm., form A, 2200 volts, and is the usual steel mill type of construction, but the motor will have six collector rings, each end of the three secondary phases being brought to a collector ring. The motor has a shaft extension on one end for receiving a coupling for coupling to the gear unit and has a shaft extension on the other end for mounting an ohmic drop exciter rated 14 kva., 450/360/270 rpm.

The regulating set will consist of two PCR regulating machines, each 480 kva., 514 rpm., a synchronous motor 1175 hp., 514 rpm., and a direct current exciter 18 kw., 514 rpm., 125 volts, for supplying the excitation to the synchronous motor fields. The synchronous motor on the regulating set replaces the induction motor usually there, because this customer desired the maximum possible power factor correction. The synchronous motor will be started in the usual way by means of an auto transformer used in conjunction with the switchboard apparatus.

Two regulating machines are used instead of one for several reasons. Due to the large capacity of the drive, if one regulating machine were used, it would of necessity have been a large unit and consequently would have to operate at very slow speed. This would of course mean that the induction motor or synchronous motor driving the set would also have to be a slow speed unit. By the use of two regulating machines in series, each unit is one-half of the required capacity and a higher speed may be used for the set, thus reducing the cost. A further advantage of no small moment is that by the use of this scheme, a much lower secondary current in the main motor results.

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*Industrial Engineering Department, General Electric Co., Schenectady, N. Y.

which permits the use of smaller contactors and resistors of lower current capacity and makes the installation work less difficult. A lower secondary current results because by the use of two regulating machines in series a higher main motor secondary voltage may be used.

In case it is desired to remove one regulating machine from the combination, the electrical circuit to the machine will be removed and suitably connected, three of the collector rings will be short circuited, and the equipment will operate with one regulating machine in which case one-half of the total regulation may be obtained both above and below synchronous speed.

A sketch is attached which shows the schematic arrangement of the regulating machines, main induction motor secondary and the secondary magnetic panel and resistor.

As will be noted, the main induction motor has six collector rings, with each end of each secondary phase connected to a collector ring. The control is arranged so that in starting, the phases are kept separate and the resistance is shorted out along each phase, the "Y" point being made only when the main motor is up to speed. In this manner the effect of a "Y" voltage for the regulating motors is obtained but the rotor winding is never subjected to the "Y" voltage when starting.

This scheme is feasible only for large equipments and in this case was particularly advantageous because the two regulating machines used on the regulating set are electrical duplicates to other regulating machines in service at the same plant.

American Pulverized Fuel Equipment Proves Popular in Europe

The Fuller-Lehigh Company announce the closing of a contract last week through their European representatives, Messrs. Babcock & Wilcox, Limited, with the Societe D'Electricite de Paris for a pulverized fuel installation at the St. Denis Station, which will be far the largest installation of his kind yet made in Europe. The St. Denis Station is located just outside of the Paris City limits on the River Siene.

The boiler equipment consists of eight B. & W. boilers each of 1,000 square meters (10,760 sq. ft.) of heating surface, producing 55 tons maximum of steam per hour each at 315 pounds pressure and 375 deg. C.

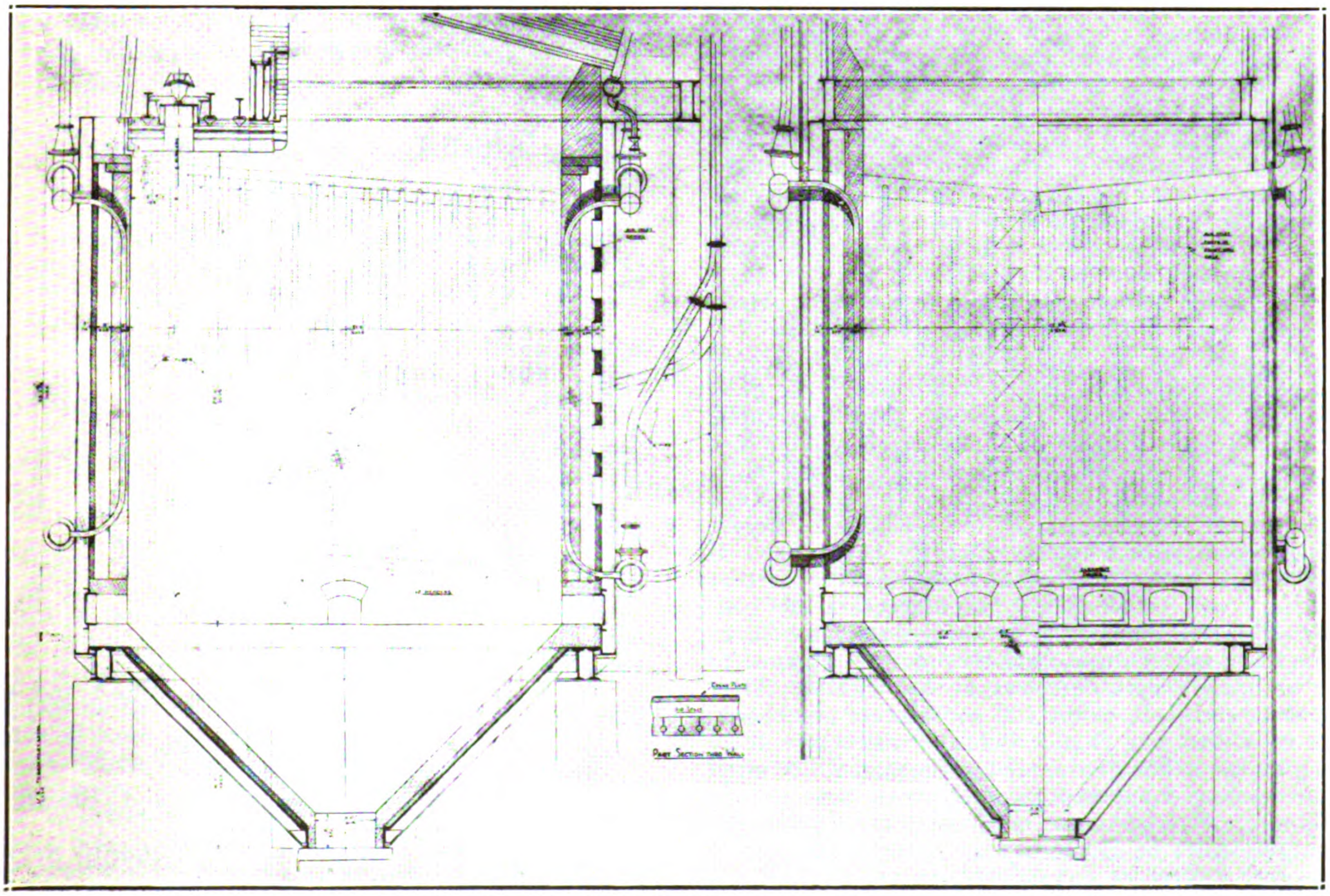

FIG. 1—*General furnace arrangement showing 1100 hp. boilers equipt for firing pulverized fuel.*

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(707 deg. F.) total temperature. The coal used will vary somewhat as to quality, but will have an average heating value of 6,000 calories (10,800 Btu. per pound), with about 12 per cent volatile, 20 to 22 per cent of ash and 5 to 10 per cent of moisture, with ash fusion temperature of 1,140 deg. C. (2,084 deg. F.).

The contract includes two 6 ft. 6 in. x 50 ft. 0 in. Fuller Indirect Fired Rotary Dryers, htree 70-in. Fuller screen mills, four 9-in. Fuller-Kinyon pumps, and transport system for conveying the pulverized fuel from the milling plant to the boiler bins, together with Fuller feeding and burning equipment.

The general furnace arrangement showing water cooled walls and method of introduction of secondary air is shown in Fig. 1.

Other interesting contracts recently placed for Fuller-Lehigh pulverized fuel equipment for boilers include: in Holland, Hague Electricity Works, The Hague, (719 hp. boilers) and Rotterdam Electricity Works, Rotterdam (649 hp. boilers); in Germany, Grosskraftwerk of Stettin (500 hp. boiler); in Czecho Slovakia, the Witkowitz Steel Works, Witkowitz (250 hp. boilers), and in England, Castner Kellner Alkali Company, Ltd., Runcorne, (529 hp. boiler), and the Birmingham University, Birmingham, (commercial scale demonstration plant for University Research Laboratory).

Don't Buy Inefficient Machinery

By W. F. Schaphorst, M.E.*

Sometimes buyers complain about their machines being inefficient after it is too late. They say that they were "stung". I know of a case of this kind in which the machine used was guaranteed to render a certain performance, but from the start it failed to do so. The guarantee was good for one year only. Both the manufacturer and user were to blame, I contend, because the machine certainly wasn't "as represented", and the buyer was too lenient. The manufacturer insisted that after a time when the machine was properly "worn in", it would come up to the prescribed mark. But it never did, and the owner is still waiting. The year has passed and the guarantee is no longer active. The owner can't hold the manufacturer any more.

This does not happen often nowadays, because most reliable manufacturers are willing to make good even after several years, guarantee or no guarantee. The point I want to make is that there is seldom any excuse for buying inefficient machinery of any kind, unless one sets out to buy something cheap. One can hardly expect a cheap product to be efficient. Before buying expensive machinery, though, one has several ways of determining beforehand whether or not that machinery will be efficient. Manufacturers are generally willing to make tests before the machine leaves the factory, and at these tests the buyer is allowed to have as many representatives as he wishes. After such tests are made to the full satisfaction of experts, there is seldom any chance that the machine will go wrong or fall below guaranteed performance. It often pays to employ competent experts for the selection of machinery. Lastly, if the machine doesn't fulfill the guarantee, don't be afraid to ask the manufacturer to make good. Present day manufacturers are anxious to make good, because they know that any case of poor or unsatisfactory performance means a "black eye" for the manufacturer.

3,000 More Employes at Weirton

Further announcement has been made regarding the expansion program of the Weirton Steel Company to the effect that additions to be made to the company's plant at Weirton, W. Va., meant an expenditure of from $10,000,000 to $15,000,000 within the next five or six years.

It was further stated that during the period of construction of coke ovens, sheet mills, tube mill, blast furnace, coal docks, etc., employment would be given to approximately 2,000 workmen. The company anticipates that it will require from four to five years to build the additions planned and appropriated for.

Employment for at least 3,000 men will be provided by the new units which will bring a material increase in the annual payroll to be distributed in the district.

In speaking of the company's expansion program, an official of the Weirton Steel said that when the new construction is completed the Weirton company will be one of the largest independents in the United States.

The steel company's huge program has renewed agitation for the immediate building of the proposed new suspension bridge connecting the northern section of Steubenville with the West Virginia steel town. The promoters of the bridge project recently secured a three-year extension of time pending completion of their financing plans, but early action to bring about the building of this bridge if being urged by business interests.

British Iron and Steel Institute

(Continued from page 374)

C. A. Edwards and L. B. Pfeil, "The Tensile Properties of Single Iron Crystals and the Influence of Crystal Size upon the Tensile Properties of Iron."

C. F. Elam, "The Orientation of Crystals Produced by Heating Strained Iron."

J. Newton Friend and W. E. Thorneycroft, "Ancient Iron from Richborough and Folkestone."

R. H. Greaves and J. A. Jones, "The Effect of Temperature on the Behavior of Iron and Steel in the Notched Bar Impact Test."

L. Grenet, "Notes on the Iron-Nickel and Iron-Cobalt Equilibrium Diagrams."

H. Kamura, "Reduction of Iron Ores by Hydrogen."

J. L. Keenan, "Blast Furnace Practice in India, with Special Reference to Economy in Coke Consumption."

W. R. Martin, "The Davis Steel Wheel and Its Manufacture in England."

J. A. Mathews, "Retained Austenite."

H. Flodin, "A New Direct Process."

J. H. Partridge, "The Magnetic and Electrical Properties of Cast Iron."

A. Sauveur and V. N. Krivobok, "Dendritic Segregation in Iron-Carbon Alloys."

A. Sauveur and D. C. Lee, "The Influence of Strain and of Heat on the Hardness of Iron and Steel."

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*45 Academy St., Newark, N. J.

National Tube Lights Furnace "B" At Benwood

Furnace Recently Completely Remodeled Will Be Heavy Tonnage Producer

WITH the lighting of Furnace "B" of Benwood, one of the largest blast furnaces in the world was put into operation; most certainly the largest blast furnace of the hundreds operated by the largest of steel producers, the U. S. Steel Corporation.

This furnace is situated in the north end of the large Riverside plant at Benwood. The operation field includes ore fields and other spaces necessary, and embraces more than a dozen acres.

The furnace has been idle for more than 18 months, undergoing repairs and remodeling at a cost of more than $500,000.

The remodeling included the installing of a revolving top, which makes the furnace so constructed that it will eliminate slips that cause the disastrous explosions, resulting in loss of life and large property damage in the past.

It is estimated that approximately 500 additional men will be given employment with the lighting of this furnace to operate during the three shifts. Additional furnaces will go on in the tube department and No. 5 mill in the plate mill department will be put on.

The Semet Solvay Company, known as the Coke Works, had been working at one-half capacity with 60 ovens in operation. The Coke Works supplies coke for the two Riverside blast furnaces, and when B was lighted the additional 60 ovens were lighted at the Semet Solvay Company.

Prominent Engineers to Participate at New Haven Machine Tool Exhibition

THE importance of the New Haven Machine Tool Exhibition has this year been recognized by the railroads and several of their passenger associations have granted the half fare return privilege. Members of the American Society of Mechanical Engineers who attend should be sure to request certificates when buying ticket to New Haven, even though the fare be but 67 cents, as 250 certificates must be received to entitle all certificate holders to the reduced fare for the return trip.

Mr. Frank O. Hoagland of the Saco-Lowell Shops, chairman of the Professional Divisions Committee of the A. S. M. E., will conduct the afternoon session on Wednesday, September 9, at which time centerless grinding will be discussed. On Thursday afternoon, Mr. Ralph E. Flanders of the Jones & Lamson Machine Company, past president of the National Machine Tool Builders Association, will preside over the presentation of the papers on precision lapping and high speed cutting of brass. Prof. Dugald C. Jackson of M. I. T. will act as chairman of the session Friday afternoon at which industrial training will be discussed. Able discussions at all the technical sessions are also assured.

During the technical sessions at New Haven engineers of note will explain in detail the methods by which difficult design and production problems have been solved. Other men of wide vision will point the way to better business for both builders and the users of machine tools. While the automobile has created the largest market for machine tool equipment in the past 15 years, the influence of a new industry is beginning to be felt—that of aircraft. For this reason the appearance of William B. Stout, the exponent of the all metal airplane, will be one of the outstanding events. His paper, which will be presented on Wednesday evening, September 9, will give manufacturers an insight into what may in the near future be one of their major markets.

Two important committee meetings have also been scheduled at New Haven while the Exhibition is in progress. On Wednesday morning, September 9, at 10:30, the Special Research Committee on Metal Springs will meet at Dunham Laboratory. On Thursday morning at the same hour and place there will be a meeting of the Special Research Committee on Cutting and Forming of Metals. The work of both committees is of direct importance to the machine tool industry. That of the one last mentioned, in particular, deals with a subject which is the actual foundation upon which this industry stands.

Attention is here called to the fact that the Exhibition as well as New Haven in general will be operating under daylight saving time.

Through the vigorous efforts of the Exhibition Committee the preparations for the Exhibition are much further advanced than at a corresponding time on any previous year. In spite of the considerable extra space made available it is proving to be none too great for the demand. The regular equipment of Mason Laboratory has been removed and placed in storage, the booths have been built, many exhibits have been received and placed and an increasing number of others are arriving daily. All of this will act to

(Continued on page 380)

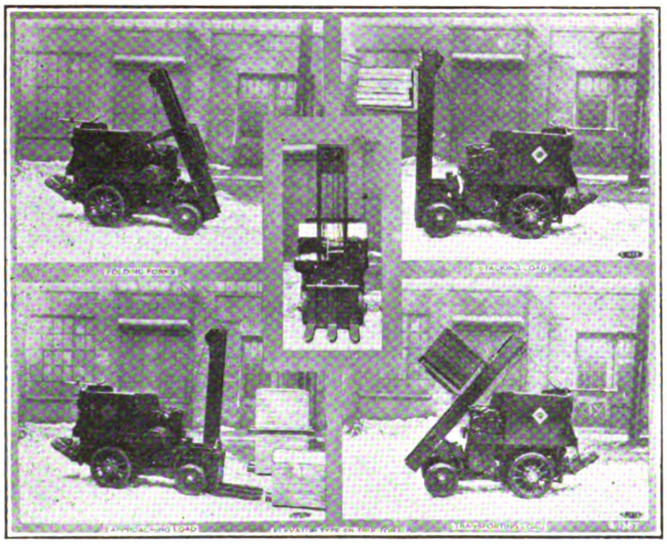
WITH THE EQUIPMENT MANUFACTURERS

Tin Plate Handling in Mill or Warehouse

In dsigning this unit the Elwell-Parker Electric Company has taken into consideration the handling of tin plate at mill and warehouse. They have studied the machines already designed to accomplish this purpose and have completed a design which satisfies all of the existing conditions, as well as caring for near future developments.

You will note in the figure shown that the vertical uprights as shown may be tilted to an angle of 40 degrees, the object being to carry the tin in the inclined position, as in this way the sheets of tin will tend to align themselves during the travel of the tructor and that all edges will be even when destination is reached, even though they may have been slightly out of alignment at the start.

The vertical and rocking motion of the forks is obtained by means of a double drum electric hoist similar to that used on the Elwell-Parker CK crane. The upper drum rocks the frame, while the lower one elevates the load.



The upper drum cable pulls the vertical uprights toward the operator against the action of a pair of heavy springs, as shown on the plueprint. These springs with cable form a cushiond rest for the load and when cable is fully paid out the uprights pitch forward slightly, which in turn throw the tips of the forks downward for insertion beneath the load.

Each of these two motions is obtained independently of the other when approaching a load of tin. Either when near the floor or stacked in a pile the forks may be raised to the proper height and thrust under the load of tin. The tin can then be lifted and either raised to a greater height or lowered to the floor, as the case may be, or it may be inclined to an angle of 40 degrees by rocking the frame, in which position it can be transferred to destination and placed either on another stack or stacks of tin or on properly arranged sticks or strips on the floor of the car or warehouse.

This method of handling tin plate will tend to keep the tin in alignment without the use of hold-down clamps of any kind other than the tilted forks.

You will also note that when the tructor is driven on an elevator without load, the forks may be folded back on the truck so as to decrease the overall length of the truck considerably.

This tructor will handle other matreials of greater bulk and lesser weight at longer outreaches. Lifting moments are calculated by multiplying the weight of the load by the distance ahead of trail axle. Take weight concentrated at load's center of gravity.

The unit is driven by electric motor, receiving power from battery carried. All four wheels steer, so tructor can be turned on congested floors. All standard Elwell-Parker safety features are incorporated. All wheel and motor bearings are ball or roller type. Capacity 3,000 to 5,000 pounds.

The Phoenix Iron Company, Phoenixville, Pa., has perfected plans for the complete electrification of its local mills, including motors, flywheel set and auxiliaries. A portion of the plant heretofore has been electrically operated, including the 22 and 24-inch structural mills, which were equipped about a year ago. The present installation will cover all other parts of the plant, replacing former steam-driven and water power apparatus, and will cost approximately $250,000. Considerable equipment will be furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh.

New Haven Machine Tool Exhibition

(Continued from page 379)

prevent the last minute congestion which sometimes spoils the opening hours of machinery exhibitions. The co-operation of the exhibitors in this respect is much appreciated by the committee.

The list of exhibitors and their products carries the names of the leaders in the industry and shows that the past year has been an active one in machine tool development. Without going into details it may be said that revelations will be made in the quantity production of very accurate parts by machines which will perform more operations at once at higher speeds and feeds than have heretofore been commercially possible. There is a persistent idea that machine tools generally reached the height of their development during the World War, when "production" was the cry from every direction. Actually, however, the quiet progress since made has rendered many of the best machines of that period definitely obsolete, if accuracy and speed be considered as determining factors—as they certainly should be. Every exhibit, as well as all the papers and discussions at New Haven, will emphasize this post-war progress.

TRADE NOTES AND PUBLICATIONS

Westinghouse Issues New 1925-27 Catalog

The Westinghouse Electric & Manufacturing Company is distributing its new 1925-27 Catalogue of Electrical Supplies. The catalogue presents a complete representation of the apparatus manufactured by the Westinghouse Company, or obtainable through its district offices or agent jobbers, and gives detailed information on electrical supplies.

The publication which contains 1,200 pages and is profusely illustrated with 4,500 engravings, lists all new apparatus designed and manufactured in the past two years, as well as all the previous established types. Included in the new apparatus for the various industries are the following:

Central stations — Asymmetric Refractors, Station Type Autovalve lightning arrestors, OB watthour meter, fittings for pipe structures, Klydonograph, LY switchboard instruments, truck type switchboards, Kilovolt-ampere Hour Meter, Multilux streethoods, Hollowspun lighting standards, combination disconnecting switches, fuses and choke coils, carrier current equipment, Inertaire transformers, Osiso, transformer thermal indicator, Sharples oil purifier, type N metering equipment.

Factories and Mines — SK Vertical Motor, low voltage static condensers, fittings for pipe structures, 200-Amp. Single-operator portable welder, furnace heating elements, electric tachometers, PX-4 portable instruments, 1½ kw. turbine generator with the least inconvenience.

Some interesting facts about the 1925-27 catalogue, showing the immensity of the task of publication, are that it required more than a ton of ink for printing, 10 tons of type to set up the text, 12,000 yards of cloth and 15 tons of binding to make the covers, and 4,500 engravings for the reproduction of photographs and diagrams. To paste the thumb index tabs in the notches, a feature designed to assure convenient reference, required the labor of 29 operators for 45 days, and the paper used to print the complete edition, if spread out flat, would cover an area of 25,000,000 square feet.

Agfil Bulletin

The International Process & Engineering Corporation of New York are distributing an eight-page, illustrated bulletin describing their new and interesting process of boiler scale removal.

Simplicity is the keynote. Very minute electrical currents, generated by a small thermopile which uses head radiated by the boiler, operates the equipment. There are no moving parts and no upkeep. Used in Europe for several years where over 300 installations are in successful operation, the Agfil is now being introduced in America. The bulletin shows a cross-section of a typical water-tube boiler with the equipment located in place.

The Research Corporation, 511 Wood Street, Pittsburgh, will furnish all desired engineering information.

McKinney Steel Installation

A 9,000-hp. synchronous motor, to be installed by the McKinney Steel Company at its River Furnace plant, Cleveland, will have the highest continuous hp. rating of any industrial motor in the world. This motor will be direct connected to a Morgan continuous billet mill, which will probably be in operation early in 1926.

The mill will have 10 stands of rolls, six of which will be 21-in. and the remainder 18-in. The motor will be made by the General Electric Company and will be rated 9,000 hp., 107 rpm., 6600 volts, 3 phase, 25 cycles, to operate at unity power factor. The motor will have a shaft extension on both ends and will be coupled to a long lay shaft running the length of the mill with bevel gearing to each stand of rolls.

This will be the first large steel rolling mill in the world to be driven by a synchronous motor. Practically the only other instance of an application of this kind is in the case of some tube rolling and piercing mills in this country which are driven by synchronous motors of approximately 1,000 hp. The usual practice has been to drive such a mill by an induction motor. The McKinney Steel Company now has in use a Morgan mill of practically the same size, but of somewhat lower speed, driven by a General Electric, 5750-hp., 40 deg., 94 rpm., induction motor, which has been in service for about nine years.

The new Whiting Corporation catalog, No. 200, has come to us. As an assembly of crane and foundry equipment it is a masterpiece.

Bound in a most attractive embossed loose-leaf cover it contains general and specific information covering the wide range of equipment with which the name Whiting is synonymous.

The individual index pages title cranes, cupolas, ladles, tumblers, core-ovens, trucks—turntables—trolley systems, air-hoist elevators, converters, brass foundry equipment.

No engineer's file should be without it. Ask the Whiting Corporation, Harvey, Ill., for catalog No. 200.

The Sloss-Sheffield Steel & Iron Company, Birmingham, Ala., has purchased the Rising Fawn blast furnace at Rising Fawn, Ga. This furnace was built in 1873 and was last operated by the Georgia Steel Company in 1907. This company also purchased the Anniston, Ala., furnace of the Woodstock Operating Corporation. Both furnaces were bought for their blowing engines which will be shipped to Birmingham. Remaining equipment and stacks will be broken up and scrapped.

John W. Griffiths has resigned from the Bethlehem Steel Company. For the past three years Mr. Griffiths has had charge of the Lehigh open hearths of the Bethlehem plant.

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BY-PRODUCT AND CHEMICAL NEWS

Mr. W. C. McKee, late manager of the Pulaski Iron Company, has been appointed general superintendent of the Federal Furnace Plant of the By-Products Coke Corporation, South Chicago, Illinois, to succeed Mr. George F. Vosburgh resigned.

Mr. C. L. Waggoner, assistant superintendent of the By-Products Coke Corporation has been appointed general superintendent of the coke oven plant, South Chicago, succeeding Mr. P. S. Savage resigned.

Mr. Philip S. Savage, formerly superintendent of coke ovens, By-Product Coke Corporation, Chicago, Ill., has now returned to Donner-Hanna Coke Corporation, Buffalo, New York, as superintendent of their operations, replacing Mr. D. M. Rugg, recently resigned.

Mr. Dan M. Rugg, president of the Eastern States Blast Furnace & Coke Oven Association and recently resigned as superintendent of the Donner-Hanna Coke Corporation, is now in Europe on a vacation trip. Upon his return he will locate in Pittsburgh with the Koppers Company.

Flow of Gases in the Coke Oven

Examination of a piece of coke taken from the higher parts of an oven gives unmistakable evidence of the path of travel. Increase in porosity at the fracture can be explained by the fact that more gas was streaming through it while in the plastic state. When a bubble of gas contained in a plastic mass bursts, there will be an elongation in the direction of flow of the liberated portion. From the shape of these bubbles, it is indicated that the gas passes inward toward the fracture with a tendency to rise. Gases having distinct reactions were injected, from which the following conclusions are drawn: (1) From the 2nd to the 7th hour and from the 11th to the 16th hour, more SO_2 was found deeper in the charge and beyond the plastic layer than directly above the point of entry; (2) path of travel of the main gas stream was inward with an upward tendency during the 1st third of the period; (3) path was upward with an inward tendency during the 2nd third; (4) during the last third, gas passed directly via the oven wall until the last hour, when the direction was reversed and the gases passed up the middle of the charge. A rapid reverse at the beginning of the 17th hour was due to the two plastic layers meeting and the portion nearest the wall was completely coked, and had begun to shrink. Final change in the direction is attributed to the clevage taking place at the fracture of the charge and the consequent opening up of a shorter free passage to the top of the oven.—Thos. Biddulph-Smith in Iron Coal Trades. Rev. 110. 220 (1925).

Among the more recent contracts taken by the U. G. I. Contracting Company, Philadelphia, is that awarded them by Lazote Incorporated covering the furnishing and installation at Charleston, West Virginia of four 11 ft. cone top U. G. I. blue gas sets, complete with Chrisman cycle, U. G. I. automatic controls and manifolds for the use of exhaust steam in the apparatus. The contract also calls for furnishing and installing U. G. I. waste heat boiler, a blowing plant consisting of three turbine and motor driven blower units and various other auxiliary equipment required for the complete plant.

This plant will be unique in as much as it will be perhaps the first blue gas plant that has been equipped with the Pier process for operation with bituminous coal.

The General Engineering & Management Corporation of New York, which lately took over the operation of Kennett Gas Company, has placed orders with the U. G. I. Contracting Company, Philadelphia, for the installation of the Chrisman cycle on their carburetted water gas apparatus at Avondale, Pa., plant.

It is expected that the results and efficiencies on the apparatus will be greatly improved after the installation of the Chrisman cycle.

A pumping plant equivalent to the municipal water-works of a city of nearly 2,000,000 population will be part of the equipment of the S/S Malolo which when completed will be the largest and fastest high-powered passenger steamer ever built in the United States.

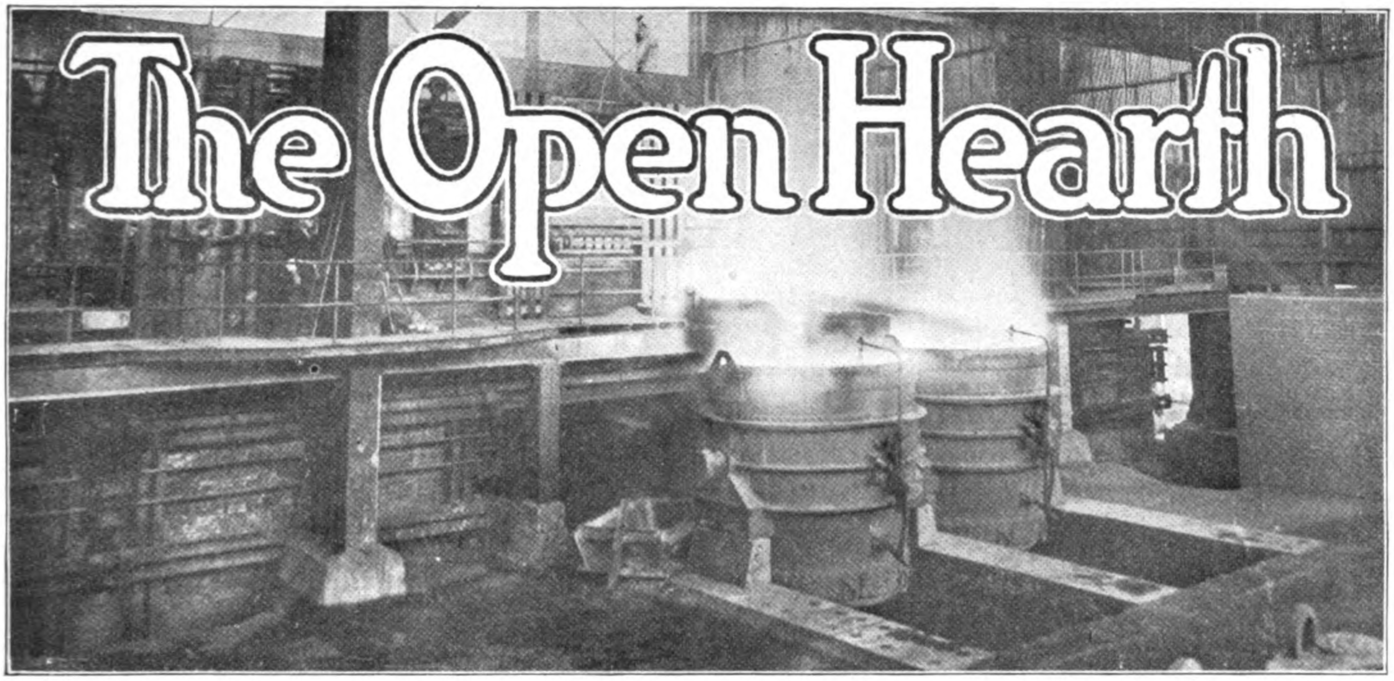
At the present time the Malolo is under construction for the Matson Navigation Company at Cramp's Shipyard, Philadelphia. When put in service in the spring of 1927 between San Francisco and Honolulu she will make the round trip in eight days, cutting four days from the time made by the fastest vessels now on the run.

The pumps of the swiftest scout cruisers of the U. S. Navy will set the standard for the huge pumps of what will be one of the finest passenger vessels on the Pacific. In exact figures, the Malolo's pumps will have a capacity of 33,615 gallons per minute, or 48,405,600 gallons per day — enough on the basis of 25 gallons per person per day, to supply every man, woman and child in a city of 1,932,000.

The Bristol (Conn.) and Planville Electric Company has recently awarded contract to the U. G. I. Contracting Company in connection with remodelling two 6 ft. sets of carburetted water gas apparatus which had been installed by the U. G. I. some years ago, and before many of the present U. G. I. improvements had been devised. Upon completion of the remodelling the demands upon the Bristol plant will be amply taken care of.

In addition to furnishing new generator, the apparatus will be equipped with full hydraulic operation together with U. G. I. master valve and other parts to bring the apparatus up to date.

The Open Hearth



General Superintendent O. J. H. Hartsuff of the Edgar Thomson Steel Works, Braddock, recently announced the appointment of Frank F. Slick as assistant general superintendent, succeeding John F. Lewis, who recently resigned. For the past 12 years Mr. Slick has been operating superintendent of the steel works.

R. J. Wysor, who has been assistant general manager of the Cambria works, Bethlehem Steel Corporation, at Johnstown, Pa., since the acquisition of the Midvale Steel & Ordnance Company by the Bethlehem company, has resigned that position to become assistant general manager of the Jones & Laughlin Steel Corporation, Pittsburgh. Before going to Johnstown Mr. Wysor had been assistant general manager of the Sparrows Point plant, Bethlehem Steel Corporation.

Elmer T. McCleary has been promoted from works manager of the Youngstown Sheet & Tube Company in the Youngstown district to assistant vice president. In this capacity he will be associated with vice presidents Charles S. Robinson and William C. Reilly in the operating management of the company's properties.

Edward Busch, who has been connected with Tate Jones & Company, furnace manufacturers, Pittsburgh, for many years, has been appointed district manager of the Hevi-Duty Electric Company, Milwaukee, for the sale of electric furnaces and equipment in the Ohio and Indiana territory, with offices at 879 The Arcade, Cleveland.

Julius B. Koehler has been elected president and general manager of the Monitor Furnace Company, Cincinnati. He has been with the company since 1916 and has recently been vice president. S. C. Bernhardt, vice president and sales manager, has been elected to the board of directors to fill the vacancy created by the death of Riffe Pope, formerly president. Mr. Bernhardt has been associated with the company for 15 years.

Joseph J. Tynan, at one time general manager of the Union Iron Works, San Francisco, has been elected vice president of the Bethlehem Steel Company Bethlehem, Pa., in charge of Pacific coast activities. He succeeds Leigh B. Norris, Pacific coast representative, who has resigned. Mr. Norris came to the Bethlehem organization through the Cambria Steel Company. He was formerly sales representative of the latter and of its successor, the Midvale Steel & Ordnance Company at New York.

G. H. Bucher, assistant general manager of the Westinghouse Electric International Company, has sailed for Japan via Seattle, and will assist in the organization of the newly formed Westinghouse Electric Company of Japan. He also will visit China and the Philippine Islands.

Russell Davis, superintendent of the Lakeside plant of the Otis Steel Company, Cleveland, has been appointed general superintendent of all the mill departments of the company. Paul E. Butler, who has been superintendent of the open hearth department, has resigned, and will reside in Chicago after September 1. James O'Neil succeeds him as general superintendent, open hearth department.

W. S. Pilling, Philadelphia pig iron merchant, who recently purchased the Saxton and Everett blast furnaces and allied properties in central Pennsylvania, including coke ovens, coal lands, etc., from the Joseph Thropp Company, which was in bankruptcy, has sold the Saxton furnace stack and machinery as scrap to a combination of Pittsburgh scrap dealers.

Another blast furnace will be built by the St. Louis Coke & Iron Company, Granite City, Ill., is accordance with reorganization plans adopted by a special committee. This is in line with the recommendation of W. G. Macguire, president of the company that went into the hands of a receiver last September.

For the enlargement of their malleable iron foundry, the Saginaw Malleable Iron Foundries of the General Motor Corporation have contracted with the Pittsburgh Electric Furnace Corporation for a battery of Moore-type furnaces, having a capacity of 24 tons of malleable iron per hour.

The American Rolling Mill Company will put its second furnace at Columbus, Ohio, in blast early this month.

NEWS OF THE PLANTS

The Armstrong Steel Company, Pittsburgh, Pa., recently organized to take over the LeMoyne Steel Company, with plant at Monongahela, Pa., has plans under way for extensions in the mill, to include the construction of a 16-inch bar mill and the installation of considerable additional equipment in other portions of the plant. It is said that the capacity will be considerably increased, approximately tripling the output of the plant since the time of its establishment about seven years ago. The company will specialize in the production of alloy and high-speed steels, as well as other special processed steels to be developed. P. A. E. Armstrong, for a number of years vice president of the Ludlum Steel Company, Watervliet, N. Y., is president of the new organization. W. H. Norris is general manager.

The Hiner Structural Steel Company, Canton, Ohio, organized by Guy C. Hiner, formerly president and general manager of the Canton Bridge Company, has completed arrangements for the purchase of the plant of the Louisville Sheet & Steel Company, Louisville, Ohio, which became defunct about three years ago and whose property has since been in charge of H. C. Pontius, in bankruptcy. The new owner has plans under way for the remodeling and improving of the different buildings and equipment, and will modernize the works for considerable increase in production. The plant is expected to be ready for service at an early date, and will give employment to close to 300 operatives. The works of the Canton Bridge Company, Canton, were acquired recently by the Moss Iron Works, Wheeling, W. Va., for a consideration said to be close to $500,000, and will be given over to steel fabrication as a branch of the two other plants of that company at Wheeling and Martins Ferry, Ohio, respectively. Officials formerly connected with the Canton Bridge Company will be associated with Mr. Hiner in the operation of the Hiner Structural Steel Co., including Paul A. Prince, chief engineer; Fred J. Pocock, erection superintendent; W. I. Tompkins, contracting engineer; and Harry Purcell, assistant sales manager.

The Republic Iron & Steel Company, Youngstown, Ohio, is said to have plans under way for the construction of a new open-hearth mill at its plant at Thomas, near Birmingham, Ala. The works now include three blast furnaces and auxiliary plant buildings, with limestone quarry, coal and ore mines, and company railroad line. The proposed new unit will provide for considerable open-hearth steel output at the mill, and will be another step in plans to develop this property. The estimated cost is placed in excess of $50,000. It is proposed to begin work early in the coming year.

The Youngstown Sheet & Tube Company, Youngstown, Ohio, is continuing its expansion program and has now authorized the construction of a new mill at its East Youngstown plant for the production of seamless steel pipe, 6-inch in diameter and smaller. The new plant will consist of a main building and auxiliary units, and will be equipped for an annual output of close to 90,000 tons of finished material, giving employment to close to 250 operatives. It is planned to place orders for machinery at an early date, and to have the unit ready for operation during the summer of the coming year. Preliminary plans are now under consideration for further extensions in the East Youngstown works, as well as the plant at Indiana Harbor, Ind., where an important expansion program for tin plate mills, recently was announced. James A. Campbell is president.

The Western Pipe & Steel Company, South San Francisco, Cal., has plans under way for the construction of a large new plant unit on local site. It will consist of a main one-story building, 90 x 1500 ft., and a number of smaller units, estimated to cost approximately $750,000. The new plant will be equipped for the production of steel pipe, tubing, and other steel products. It is proposed to ask bids at an early date and to push the project to completion. W. W. Breite, Clunie Building, San Francisco, is engineer for the company.

The Katchen Iron Works, 107 Hunterdon Street, Newark, N. J., has acquired a tract of property 100 x 105 ft., on Shaw Avenue, in the Irvington district, and has plans under way for the construction of a new plant for structural iron and steel working. It is reported to cost in excess of $60,000, including equipment. The company is understood to be planning to remove its present works to the new plant, work on which will begin at an early date.

The Jones & Laughlin Steel Corporation, Pittsburgh, Pa., has completed plans and will proceed with the construction of a new addition to its steel fabricating works on Second Avenue. Plans have been filed and a building permit issued. The structure will be one-story, estimated to cost close to $90,000.

The Reading Iron Company, Reading, Pa., manufacturer of pipe, tubing, and kindred iron and steel products, is said to have preliminary plans under way for enlargement of its mills on Oley Street, to include the construction of a number of new buildings, and the installation of additional equipment for considerable increase in capacity. The amount of appropriation has not as yet been announced. L. E. Thomas is president.

The Fostoria Pressed Steel Company, Fostoria, Ohio, has leased property on South Union Street, and will occupy the structure with a subsidiary organization to carry out a new line of production. Alterations and improvements will be made in the present building and considerable equipment installed. It will be known as the No. 2 plant of the company, of which C. B. Pifer is president.

The McKinney Steel Company, Crystal Falls, Mich., is said to have plans nearing completion for the rebuilding of the portion of its plant, destroyed by fire a number of weeks ago, causing the loss of several buildings, with reported damage placed in excess of $75,000. The reconstruction will cost approximately a like amount.

The Blast Furnace and Steel Plant

Member of the Audit Bureau of Circulations
PITTSBURGH, PA., SEPTEMBER, 1925
Entered as second class mail matter at Pittsburgh, Pa., under the act of Congress, March 3, 1879.

MORGAN
WORCESTER
ENGINEERS AND MANUFACTURERS

1891 1925

Depreciation ?

Of the
142 Rolling Mills of our design and manufacture
140 are in operation
to-day

MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS, U.S.A.